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ENGINEERING PROJECT AUTHORIZATION

PROJECT NO: CS-P-15 PROJECT LEADER(S): Ying Xiang
TITLE: 7 7/8 IADC 5-1-7 CUTTING STRUCTURE OPTIMIZATION (51X KILLER) CODE: P

OBJECTIVES

Utilize the IDEAS program and IDEAS lab facilities to design, analyze and optimize a new 7 7/8 TCI cutting structure(s) targeted to increase the rate of penetration, footage, and durability compared to the currently available IADC 5-1-7 type products (especially the Reed HP51X). Iteratively field test these new designs with the ultimate goal of establishing a 15% to 20% performance differential with our competitor's products and additionally providing functional feedback for continuing IDEAS systems development.

CUSTOMER NEEDS ADDRESSED:

- 1) Performance
- 2) Reliability

TRANSLATION:

- 1) Increased ROP
- 2) Improved life and footage
- 3) Consistent dull condition

MEASUREMENTS:

- 1) Performance Reports
- 2) Analytical/Statistical Reports
- 3) Lab Tests

BENEFITS/PAIN:

Project benefits are to: 1) establish a performance advantage over our competitors in the 7 7/8 IADC 5-1-7 product range, 2) increase marketshare/revenues in the domestic TCI market, 3) further promote the utilization of the IDEAS program and lab to improve product performance, and 4) enhance our customer's perception of Smith as a leader in technological development. Potential pain is continued lost marketshare/revenues to Reed and other competitors who dominate the market for 7 7/8 5-1-7 type products.

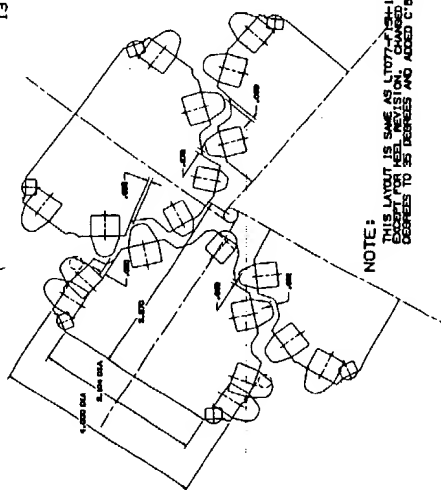
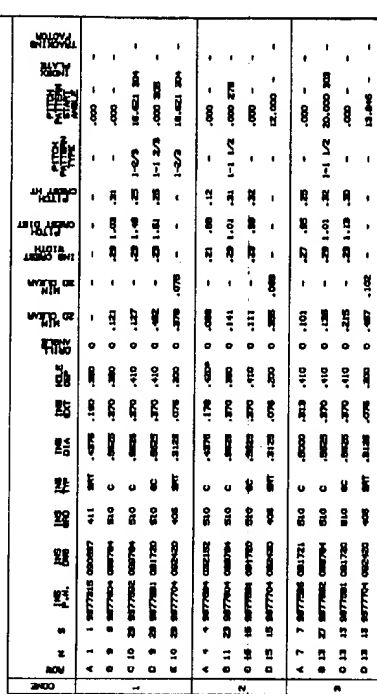
DESIGN INPUT ACCEPTANCE:

Ying Xiang 11/13/98
Project Team Leader Date

PROJECT AUTHORIZATION APPROVAL:

[Signature] 11/17/98
V.P. Engineering Smith Tool Date

F-15h ER5754

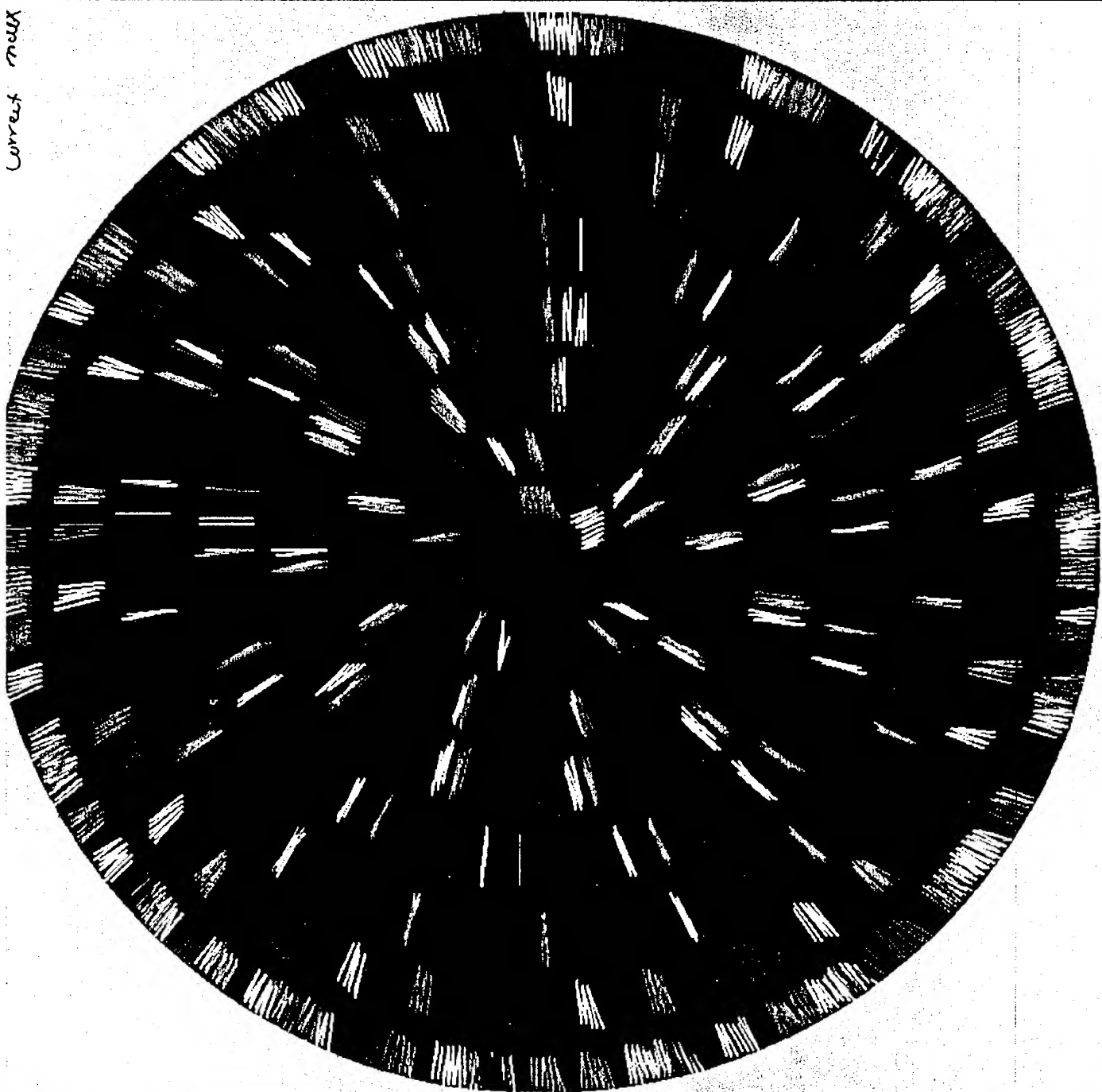


NOTE: THIS LAYOUT IS SAME AS LT077-F 134-174P EXCEPT FOR REEL REVISION. CHANGED 30 DEGREES TO 35 DEGREES AND ADDED C"INFE.

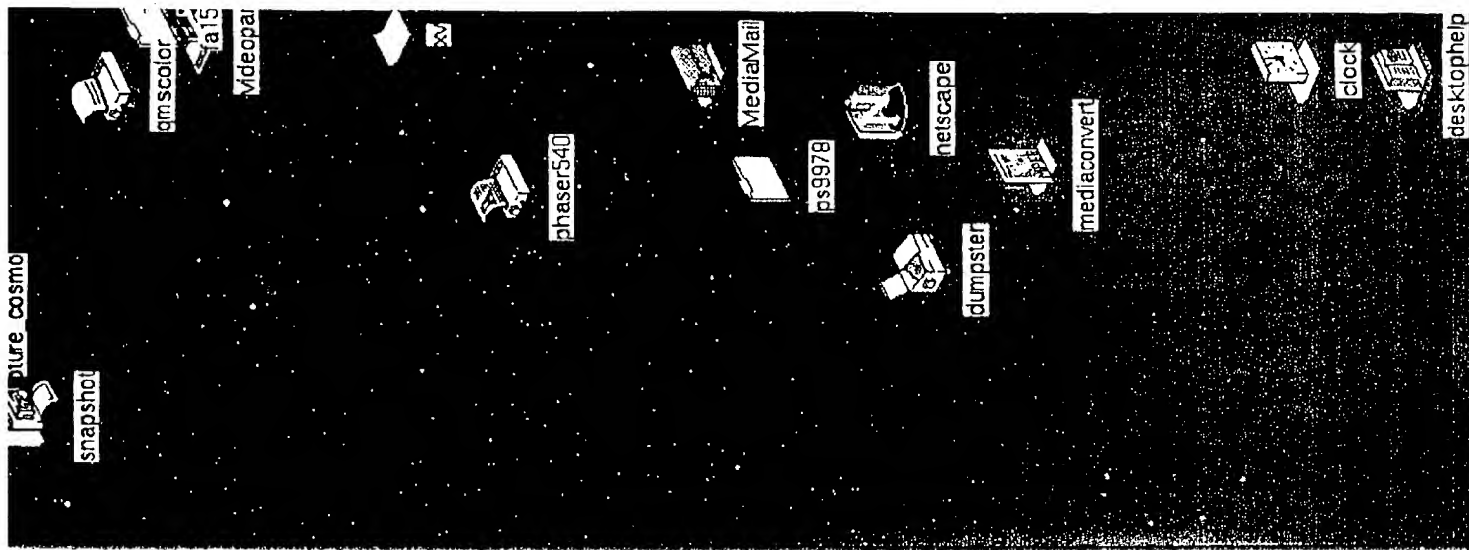
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CODE FORTIN# 1	9881780	TOTAL # INVENT#	82		APPROVED BY		DATE	
BEARING NO.	1-4889-0811	MIL. SMALL IN#	1	.000	ORDERED BY		DATE	
JOURNAL AMPL#	22-83	MILS SMALL CLP.	1	.000				

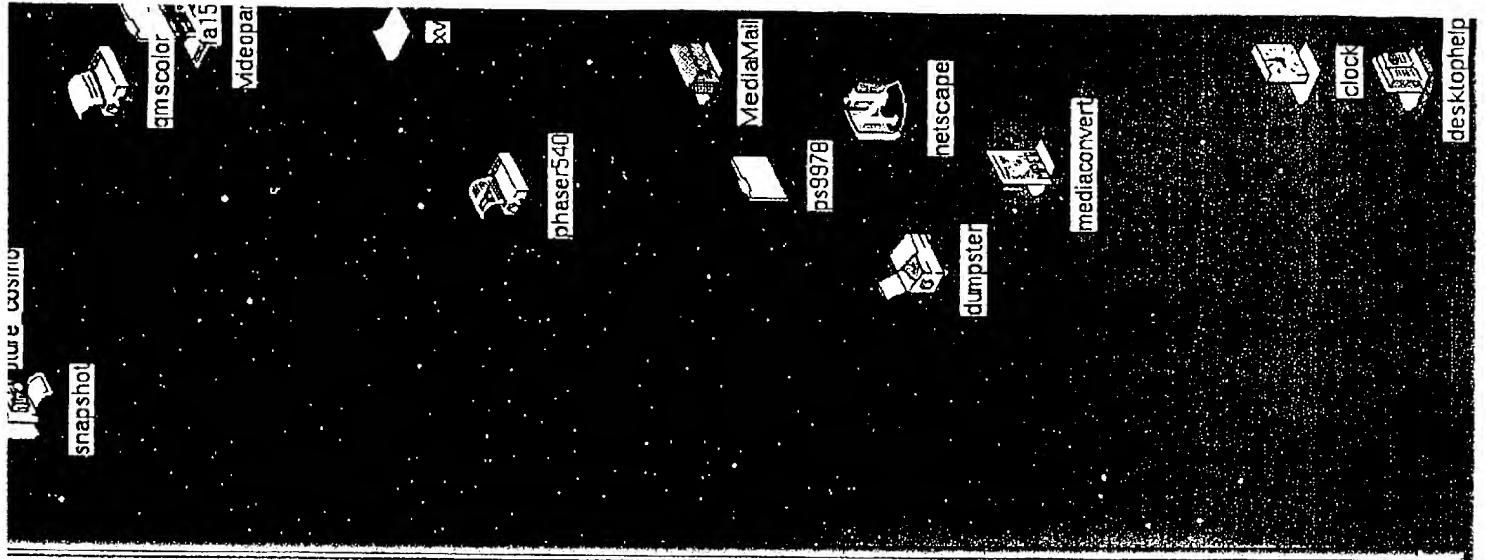
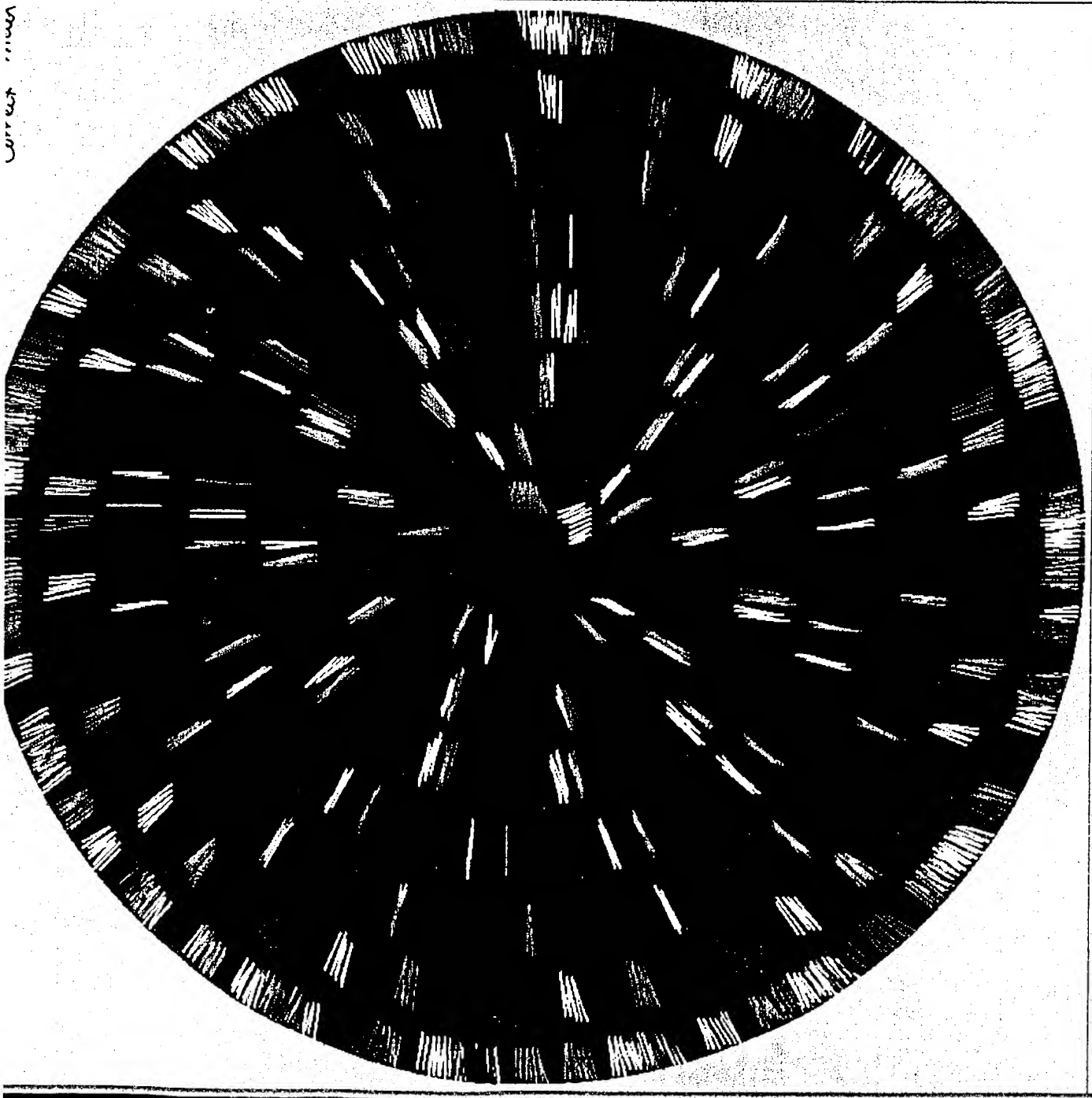
DRILL/MILL ENTITIES ARE CURRENT

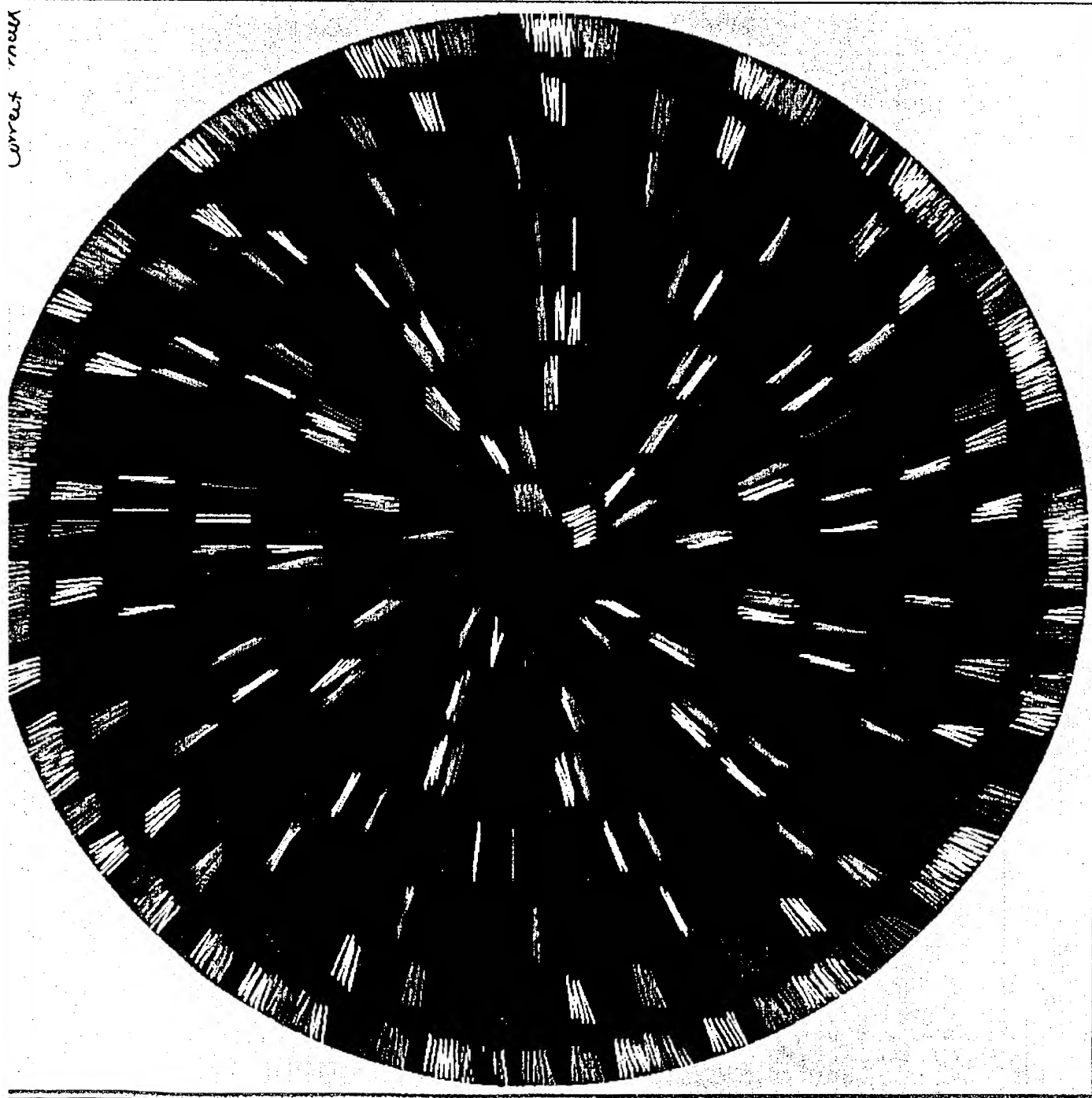
7-7/8 F2
7-7/8 F15H



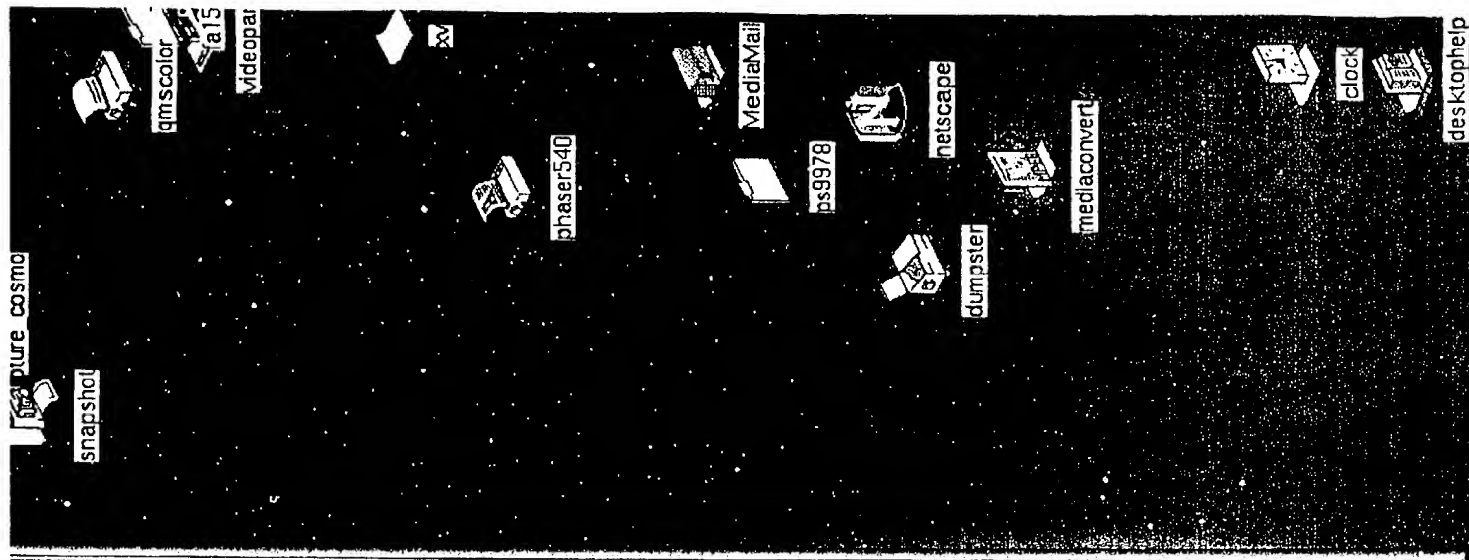
Correct next

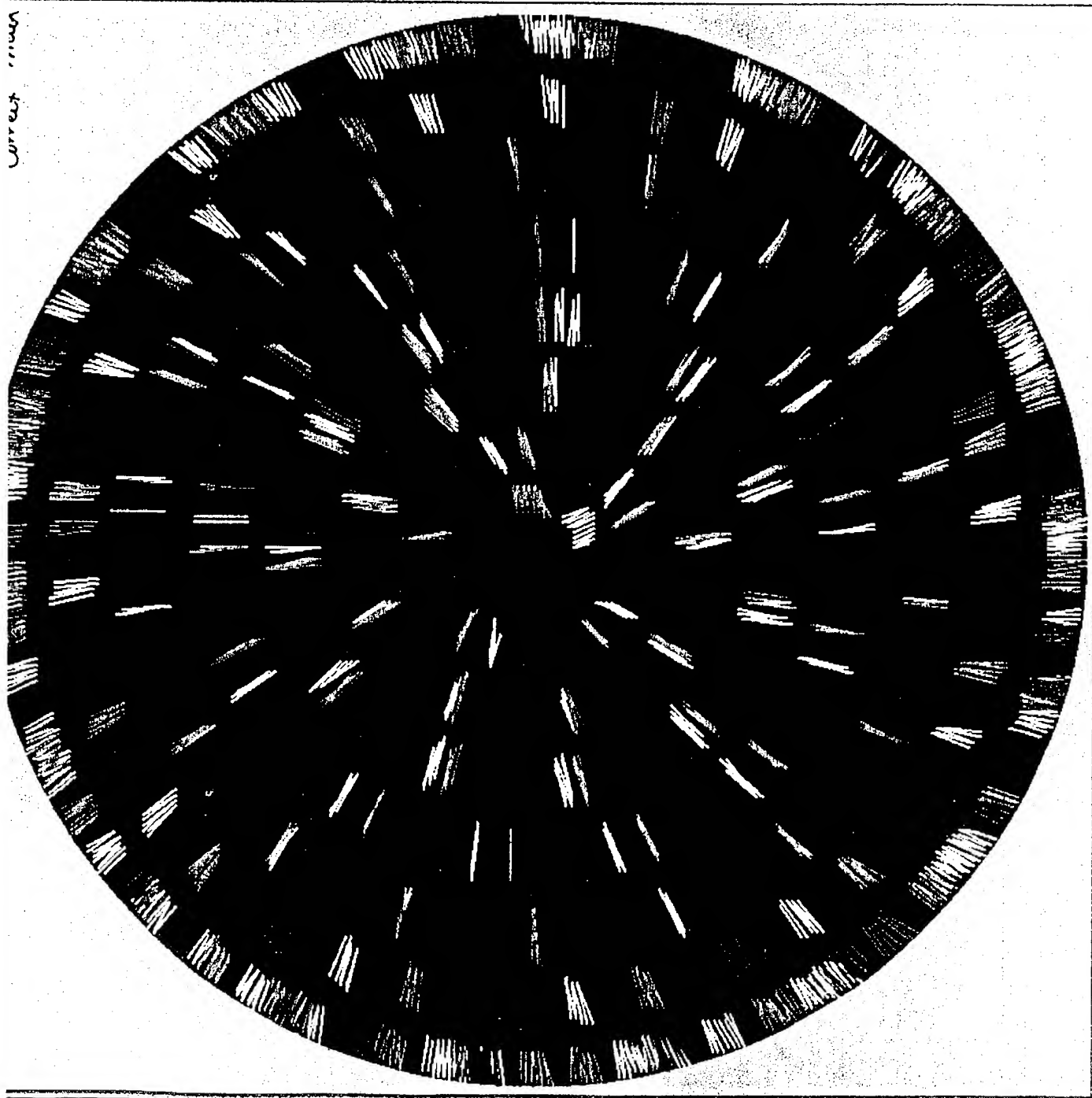




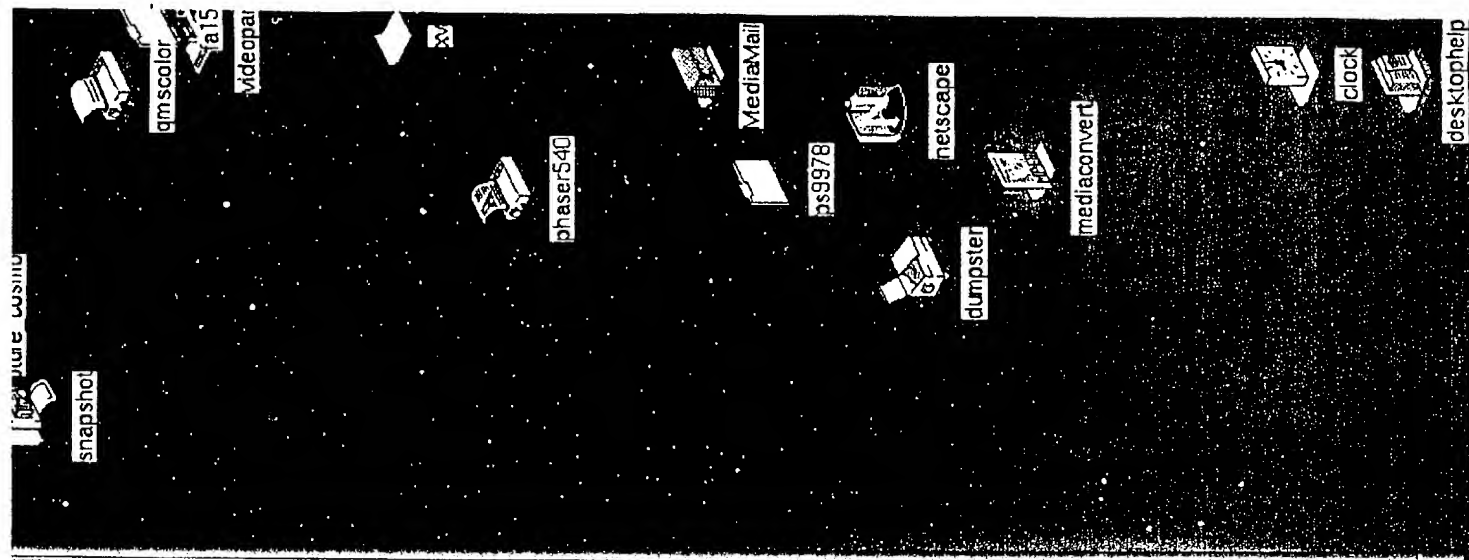


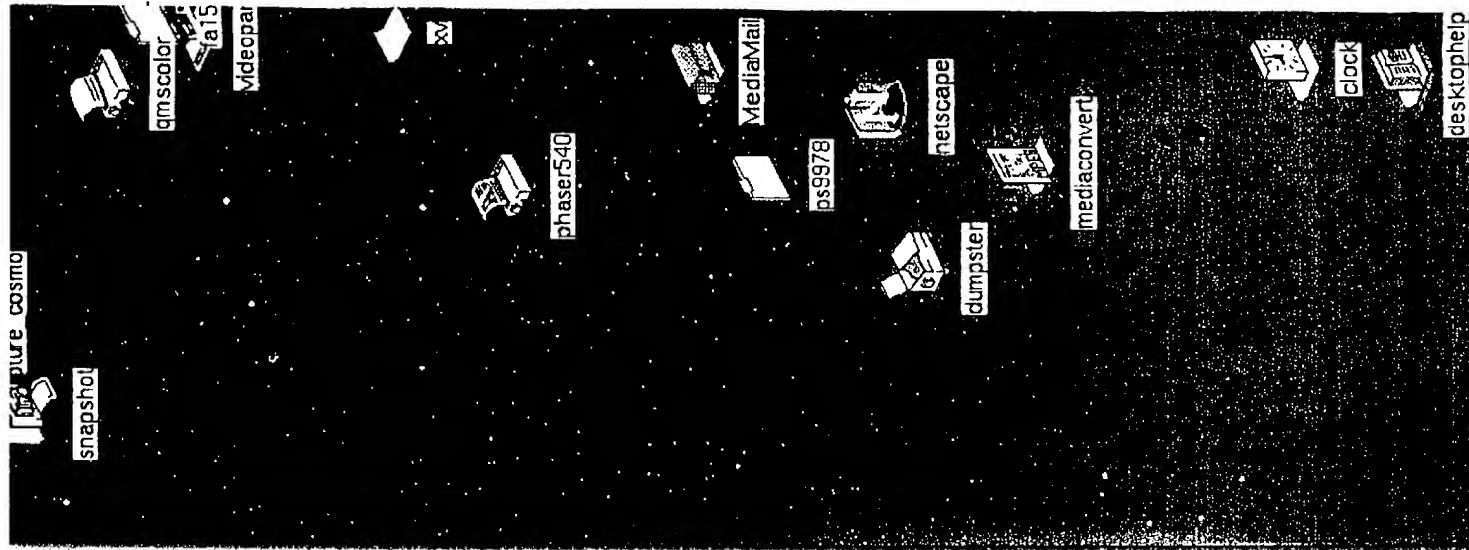
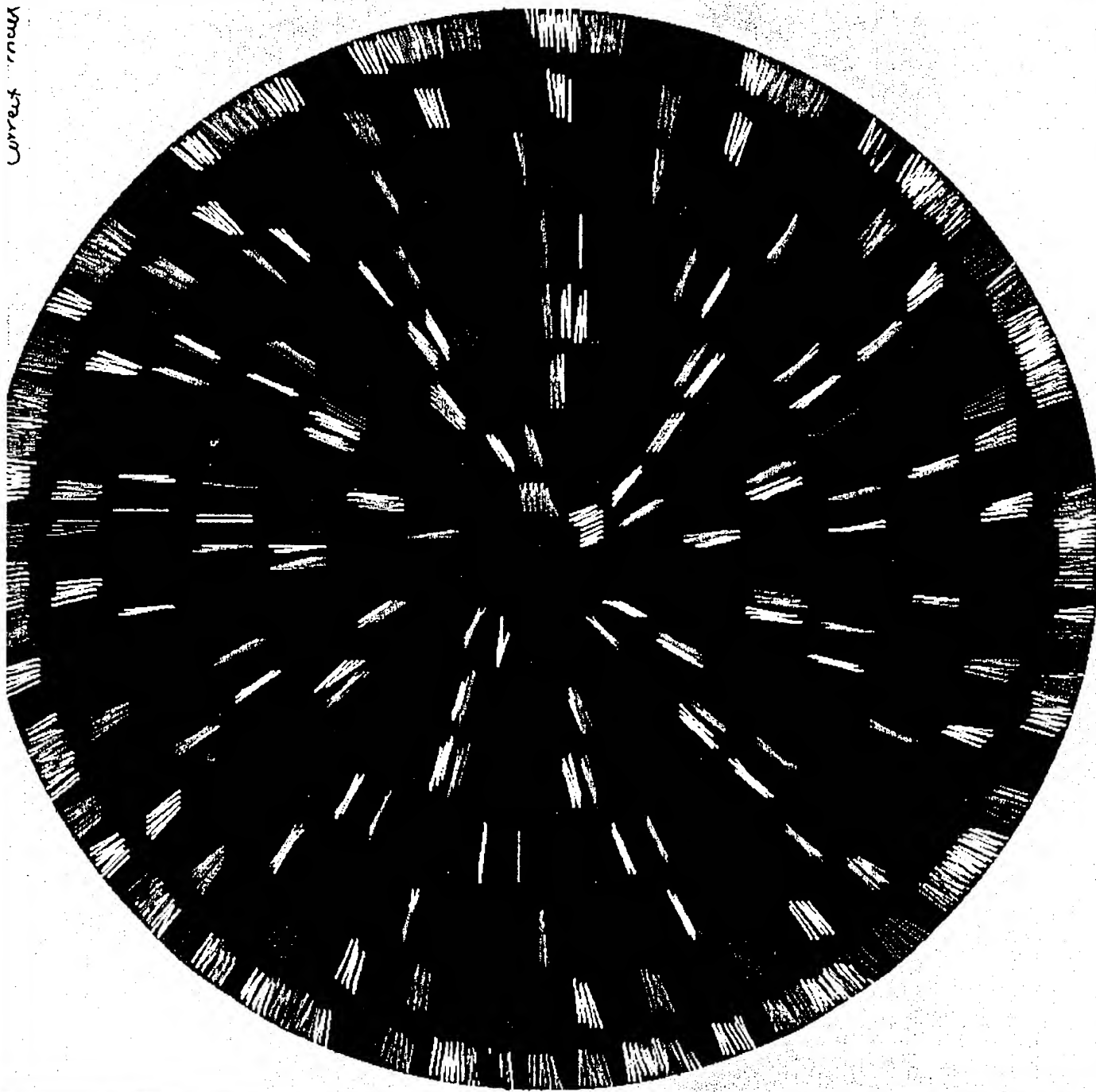
Correct name

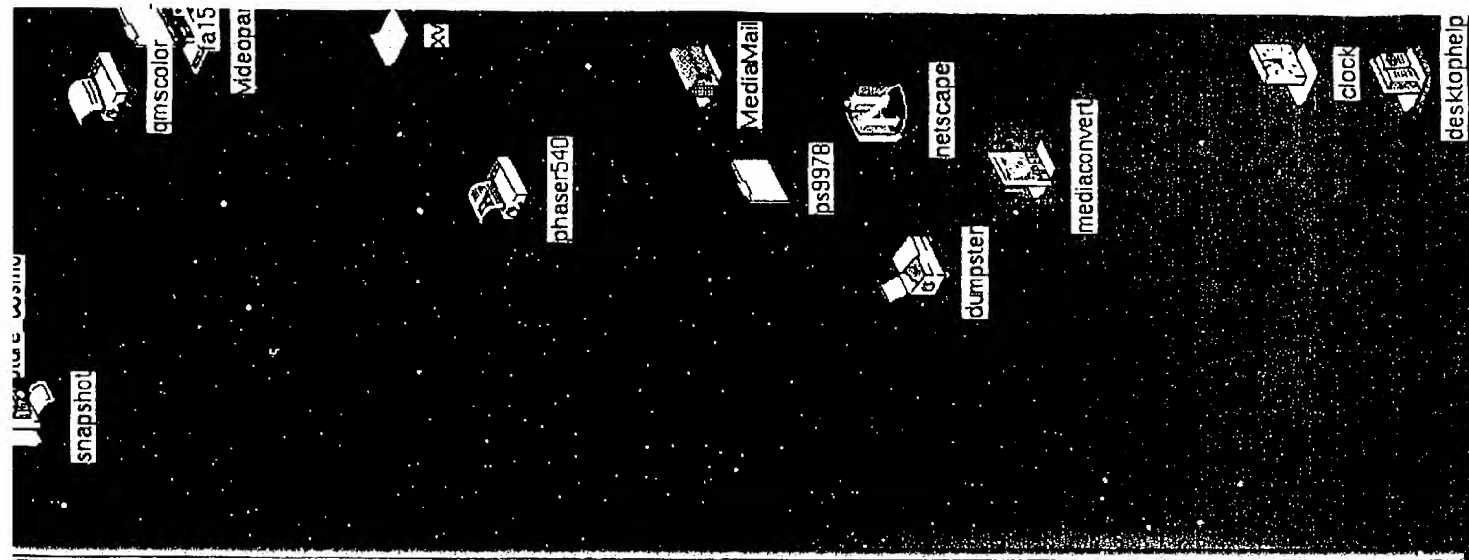
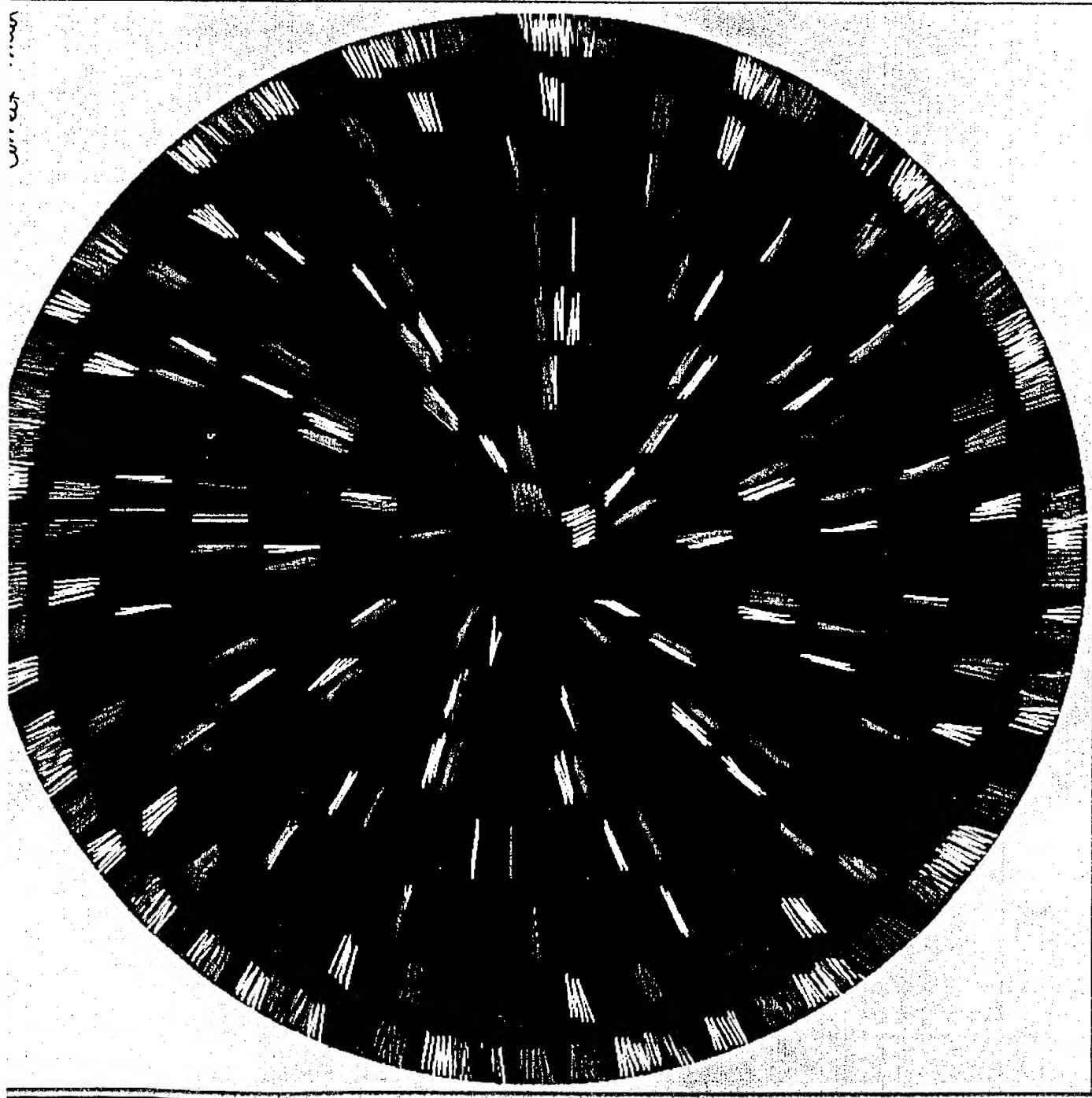


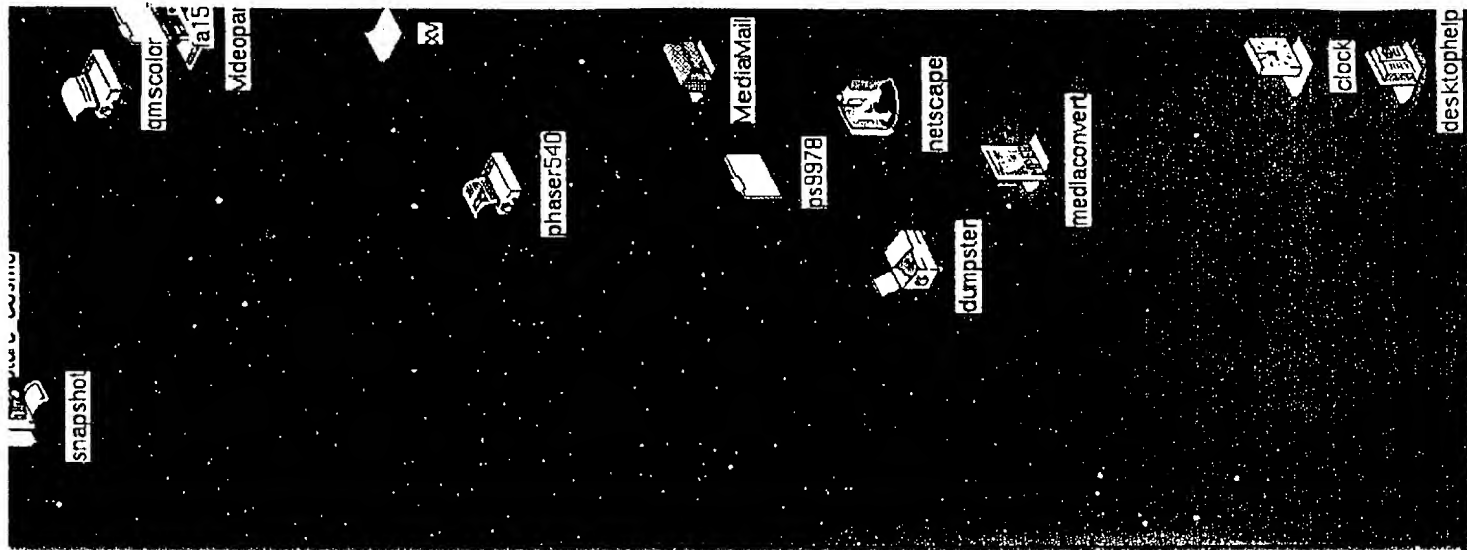
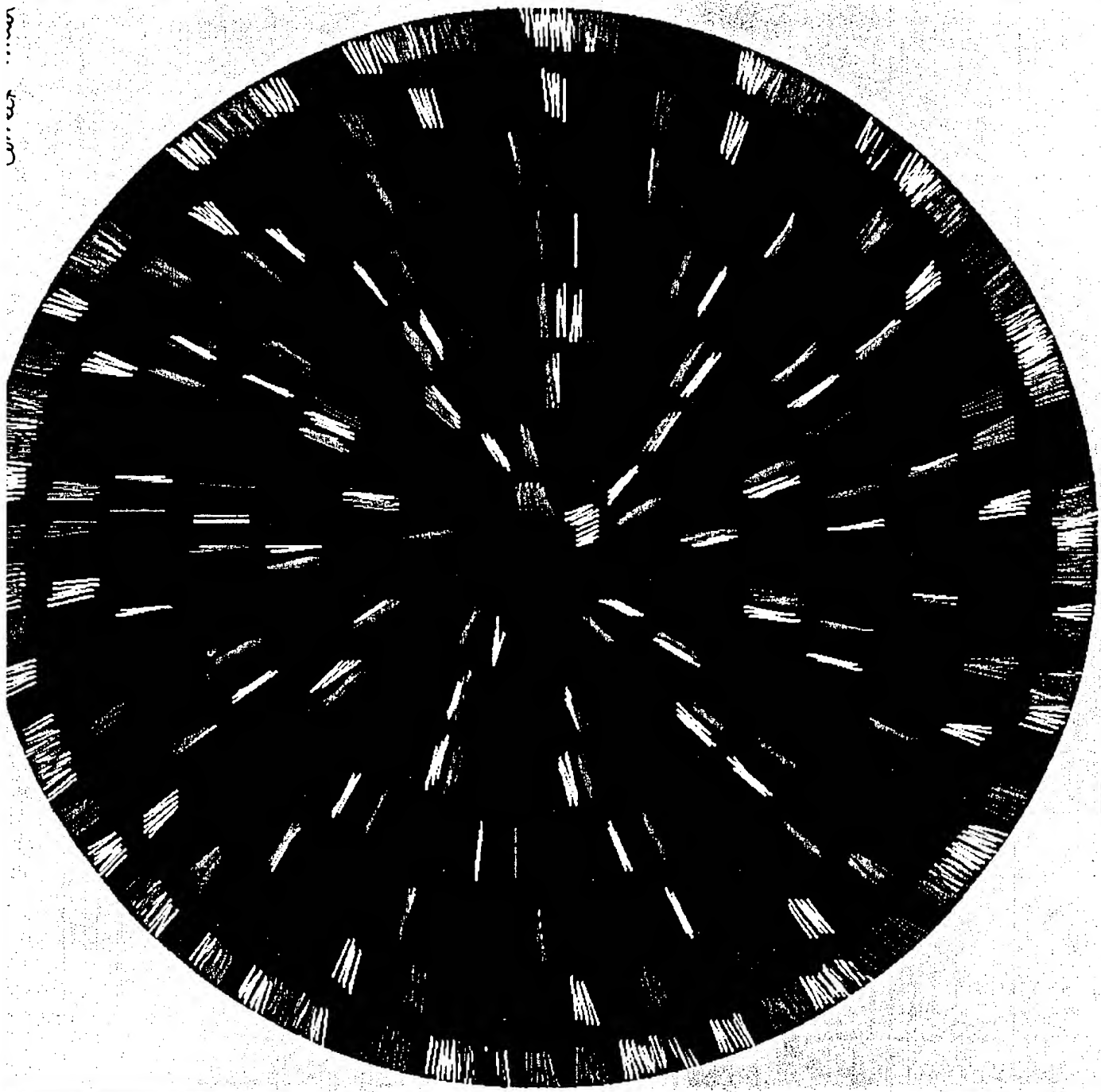


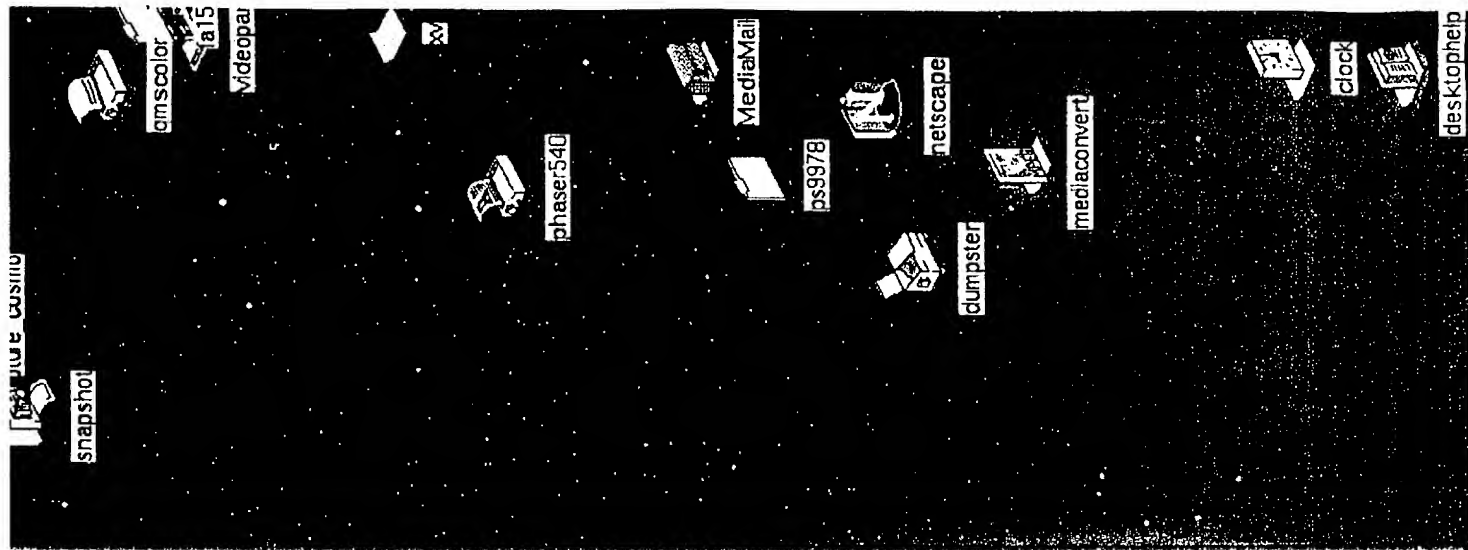
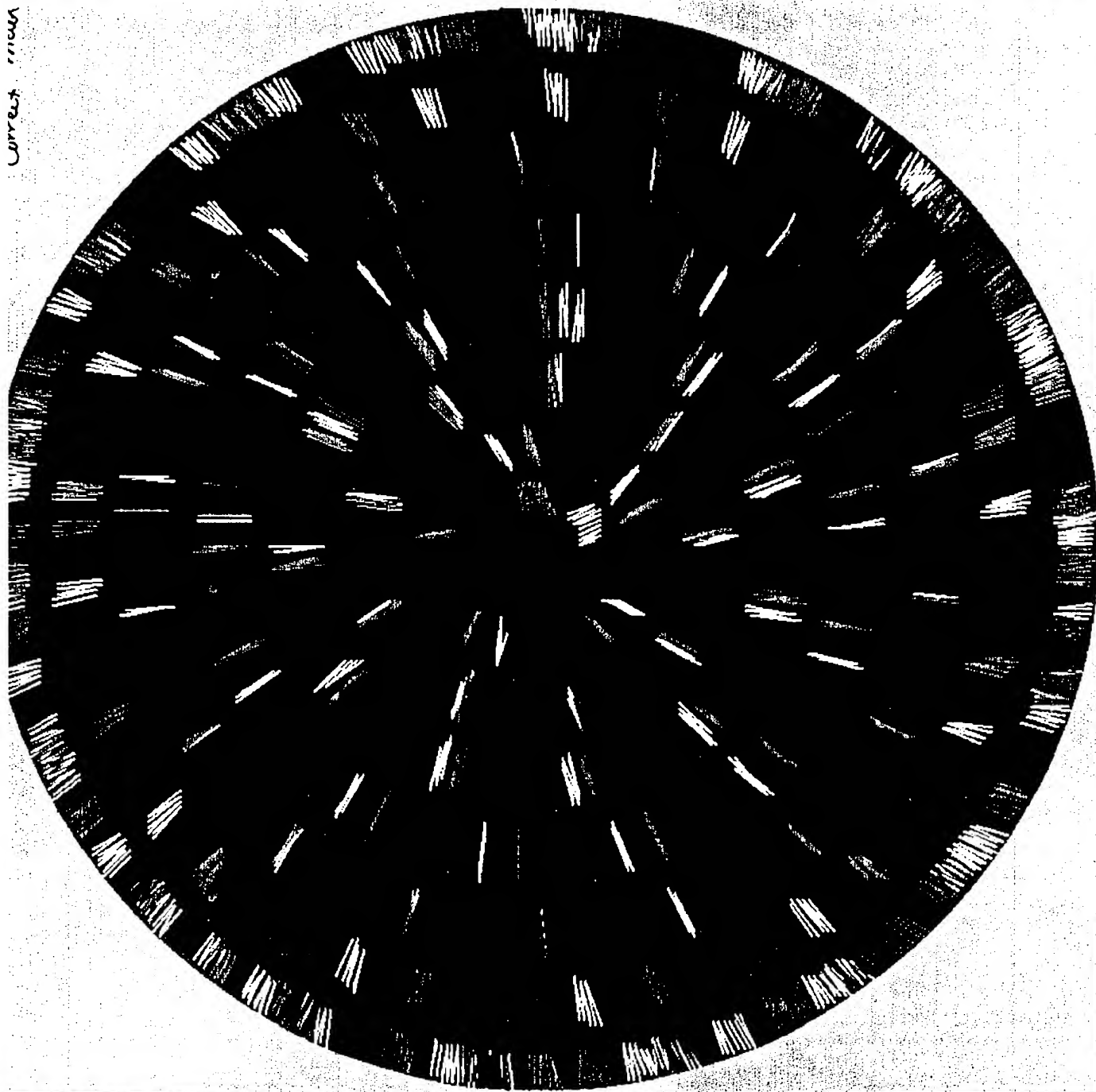
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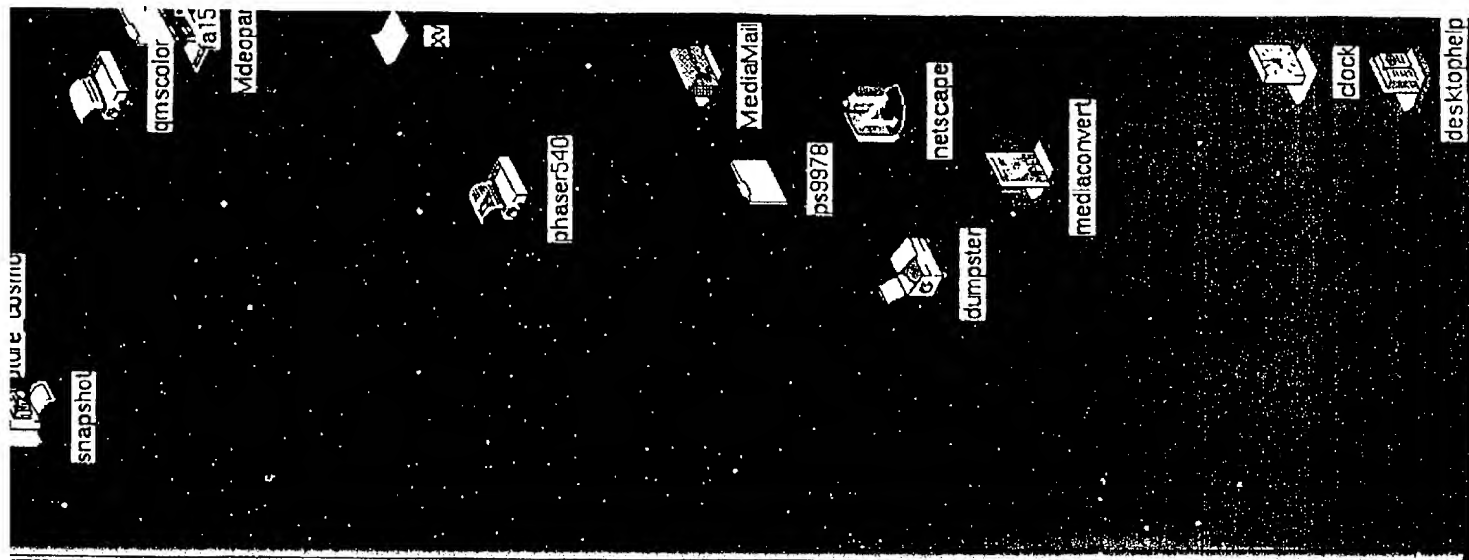
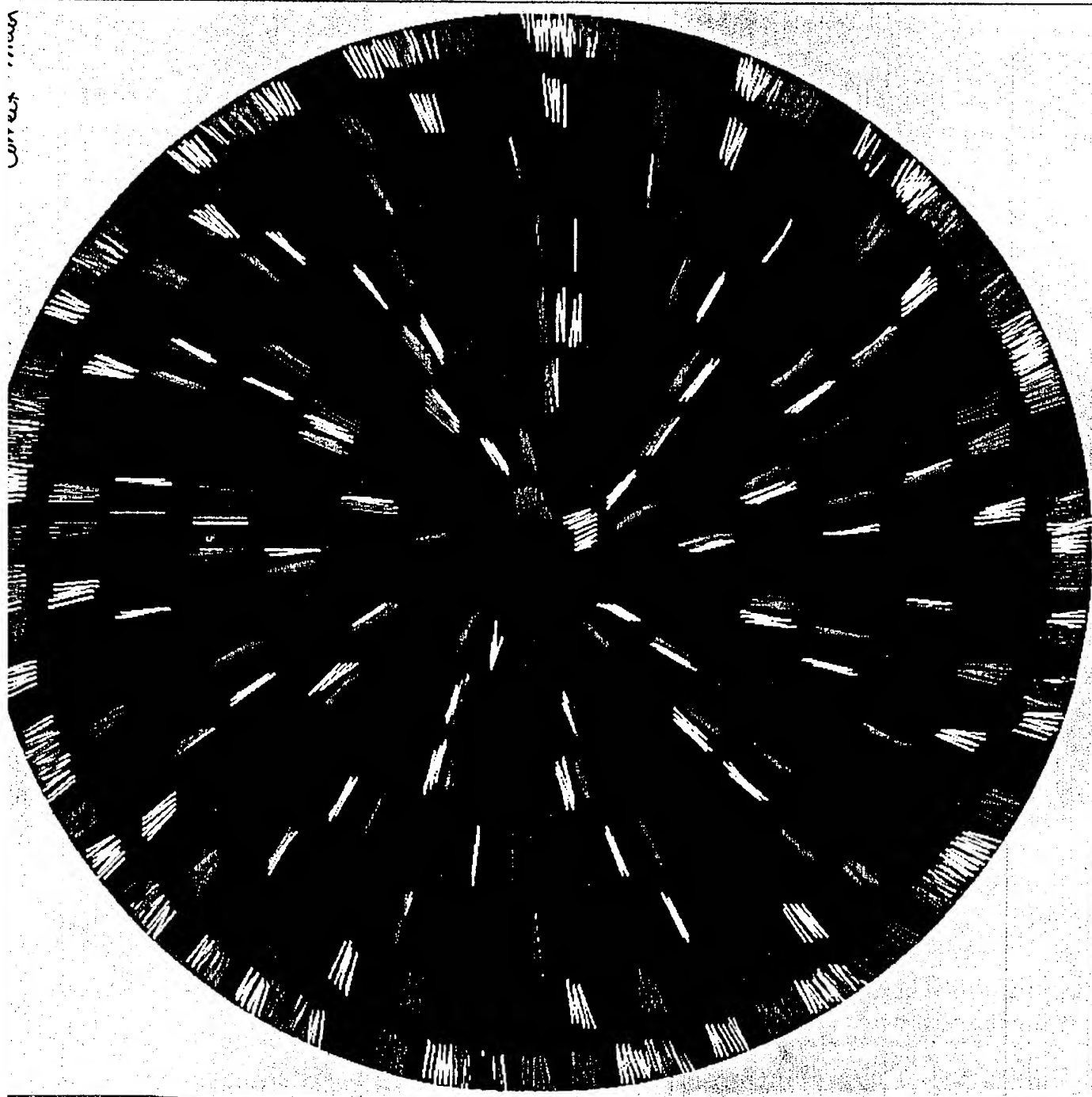


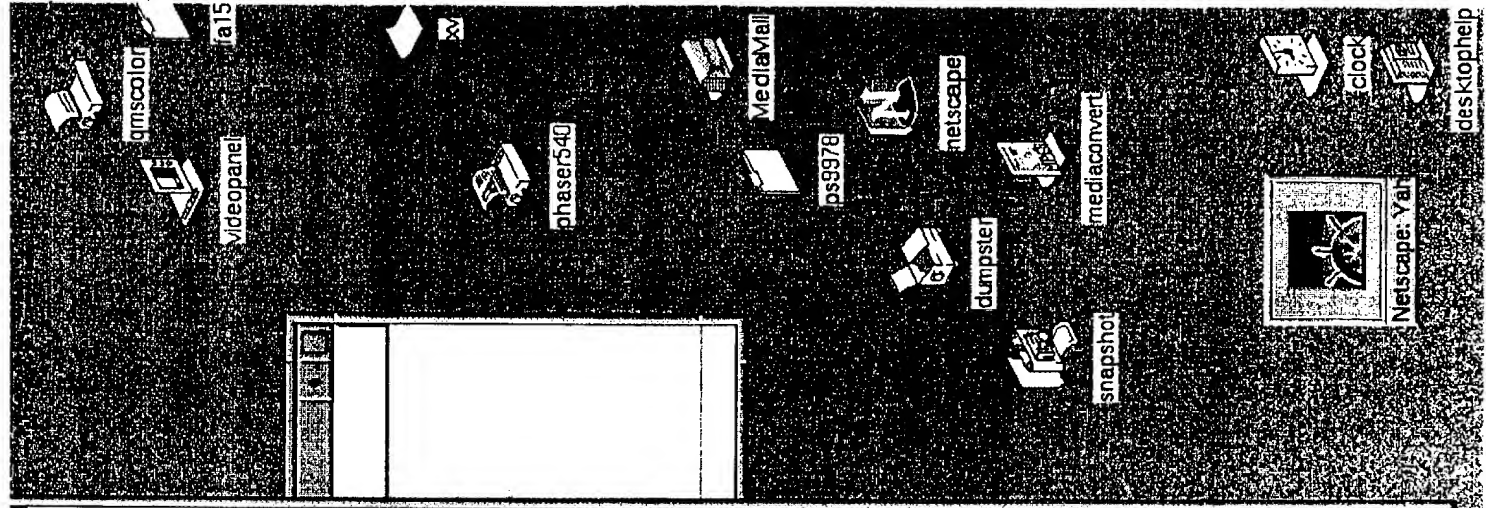




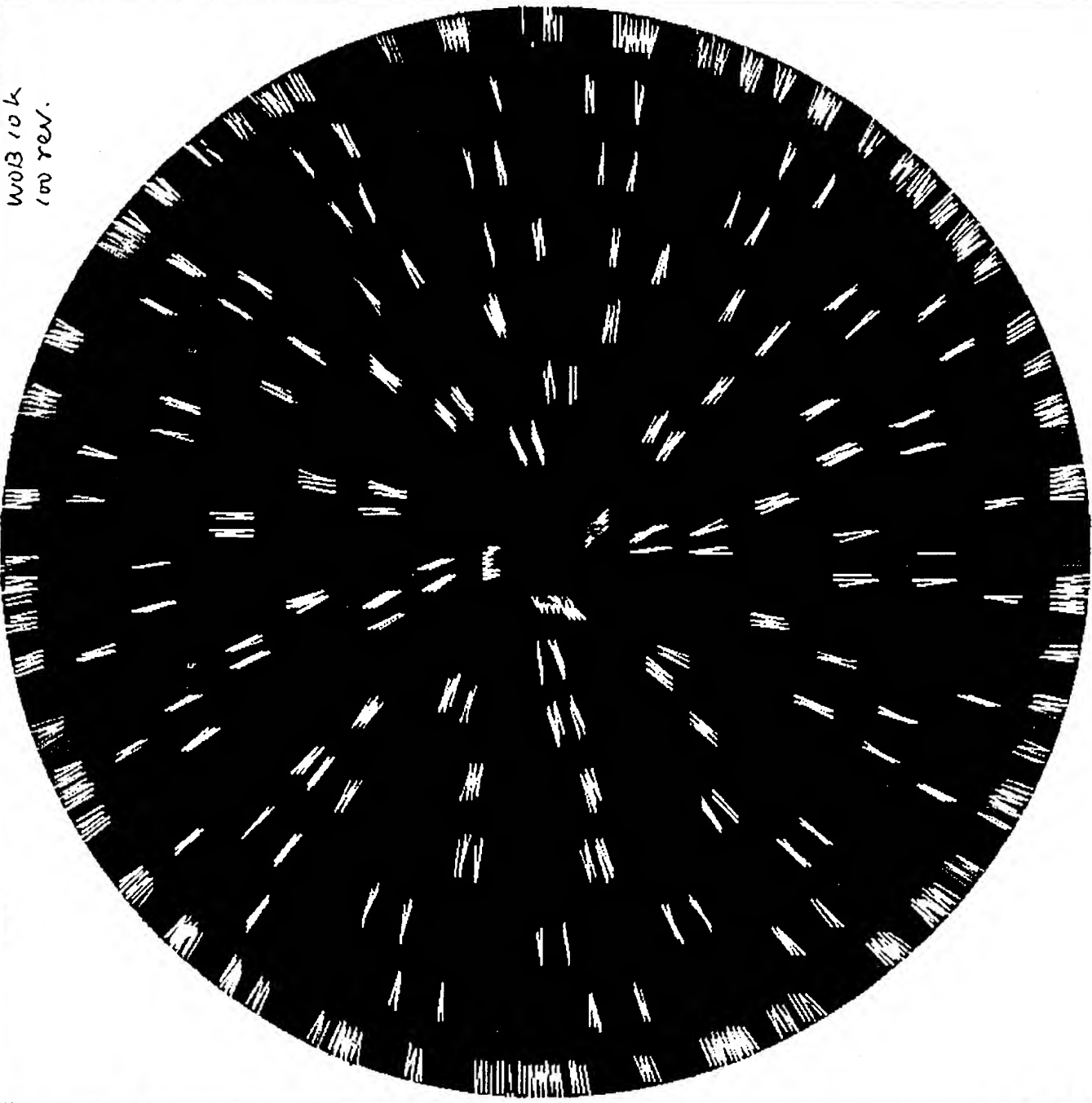








w03 104
100 rev.



Calculation Summary

ct: ./f15h1aa
 ter of Bit: 7.87 (in) [200 (mm)]
 t on Bit: 42000 (lbf) [19051 (kgf)]
 utions per minute: 85 (rpm)
 utions of Simulated: 30 (rev)
 ess coefficient of Rock: 134954 (lbf/in2) [930.5 (Mpa)]
 ritical Contact Depth of Rock: 0.054 [in] [1.4 (mm)]
 rebreakage Factor of Rock: 95.006 (Mpa/mm)
 ole area: 48.707 (sq.in)

CutArea Coverage (sq.in) %

15.17	31.14
16.91	34.71
18.68	38.35
18.26	37.48
18.62	38.22
20.64	42.37
20.80	42.70
20.67	42.44
20.49	42.06
20.90	42.91
22.05	45.27
20.75	42.60
20.94	42.99
21.75	44.66
21.96	45.08
21.39	43.92
20.92	42.95
21.04	43.19
21.31	43.76
20.39	41.87
20.88	42.87
21.13	43.38
21.04	43.20
20.42	41.93
21.65	44.45
21.18	43.48
21.44	44.03
21.17	43.45
21.24	43.61
21.24	43.61

ge of Coverage for Bit: 42.09 %

ge of Coverage for Each Row:

Row	Rmin (in)	Rmax (in)	C.Avr (sq.in)	CovI %	CovA %
1	3.886	3.937	0.002	0.12	0.00
2	3.726	3.937	0.019	0.36	0.04
3	3.154	3.851	2.148	14.02	4.41
4	2.055	2.815	3.266	28.08	6.71
5	0.773	1.428	0.829	18.30	1.70
6	0.210	0.704	0.034	2.40	0.07
1	3.884	3.937	0.005	0.36	0.01
2	3.484	3.937	1.838	17.40	3.77
3	2.488	3.247	3.813	27.88	7.83
4	1.205	1.852	1.550	24.95	3.18
5	0.229	0.690	0.045	3.38	0.09
1	3.884	3.937	0.003	0.24	0.01
2	3.534	3.937	0.388	4.09	0.80
3	2.832	3.595	3.777	24.51	7.76
4	1.595	2.319	2.497	28.04	5.13
5	0.429	0.972	0.212	8.90	0.44

enetration Depth 0.249 (ft) [76 (mm)]

ge of ROP 38.70 (ft/h) [11.79 (m/h)]

of Cone Rotary Speed to Bit:

Ratio

1.2176

1.2581

1.2223

ing Brittle File Size 5003400 (bytes)

cal Brittle File Size 3705012 (bytes)

Contacted Times 849 (times)

ct Percentage of Shell to Rock 23.5833 %

Calculation Summary

ct: ./f15h17

ter of Bit: 7.87 (in) [200 (mm)]

t on Bit: 42000 (lbf) [19051 (kgf)]

utions per minute: 85 (rpm)

utions of Simulated: 30 (rev)

ess coefficient of Rock: 134954 (lbf/in2)

[930.5 (Mpa)]

ritical Contact Depth of Rock: 0.054 [in]

[1.4 (mm)]

breakage Factor of Rock: 95.006 (Mpa/mm)

ole area: 48.707 (sq.in)

CutArea Coverage

(sq.in) %

13.15 27.00

13.45 27.62

15.99 32.83

17.90 36.75

19.16 39.34

18.72 38.44

18.10 37.16

19.03 39.08

19.44 39.92

18.89 38.77

19.97 41.01

19.35 39.72

18.09 37.13

18.30 37.58

18.84 38.69

18.07 37.09

19.37 39.77

19.20 39.41

19.96 40.98

19.21 39.44

19.38 39.79

20.33 41.74

18.94 38.88

19.49 40.01

19.73 40.51

19.20 39.42

19.99 41.04

19.19 39.40

20.25 41.57

19.06 39.14

ge of Coverage for Bit: 38.31 %

ge of Coverage for Each Row:

Row	Rmin (in)	Rmax (in)	C.Avr (sq.in)	CovI %	CovA %
1	3.907	3.937	0.000	0.00	0.00
2	3.318	3.937	1.161	8.22	2.38
3	2.884	3.572	2.868	20.54	5.89
4	1.377	2.045	2.072	28.87	4.25
5	0.105	0.554	0.064	6.85	0.13
1	3.890	3.937	0.000	0.00	0.00
2	3.323	3.937	2.096	14.95	4.30
3	1.848	2.593	2.978	28.63	6.11
4	0.454	1.014	0.367	14.24	0.75
1	3.907	3.937	0.000	0.00	0.00
2	3.321	3.937	1.707	12.15	3.50
3	2.387	3.150	3.813	28.75	7.83
4	0.899	1.533	1.316	27.14	2.70

enetration Depth 0.149 (ft) [45 (mm)]

ge of ROP 23.44 (ft/h) [7.14 (m/h)]

of Cone Rotary Speed to Bit:

Ratio

1.2623

1.2214

1.2788

ing Brittle File Size	3660912 (bytes)
cal Brittle File Size	2933052 (bytes)
Contacted Times	1694 (times)
ct Percentage of Shell to Rock	47.0556 %

Peer Review

Project Information:

Page: 1

Title: 077 mf15h

Number: CS-P-15

Leader(s): YING XIANG

Meeting Schedule:

Date: Mar.30, 1999

Time: 9.00AM

Place: ROOM2000

Meeting Objectives:

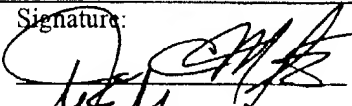
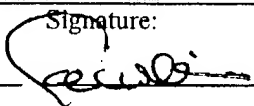
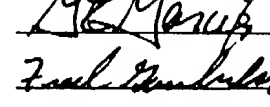
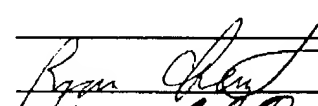
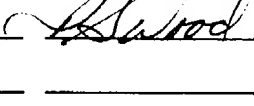
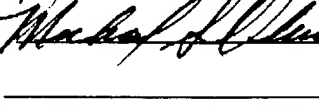
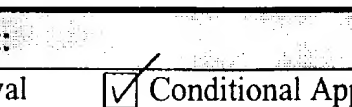
▶ Design review

Agenda Topics

Time Allotment

- | | | | | | |
|----------------------------------|------------------------------|------------------------------|------------------------------|---|----------|
| ▶ Review Product Brief | <input type="checkbox"/> PDP | <input type="checkbox"/> ECR | <input type="checkbox"/> CAR | <input checked="" type="checkbox"/> EPA | ⌚ 0 |
| ▶ Review 077-mf15h -93 Layout | | | | | ⌚ 45 min |
| ▶ open discussion | | | | | ⌚ 15 min |
| ▶ | | | | | ⌚ 30 min |
| ▶ | | | | | ⌚ |
| ▶ | | | | | ⌚ |
| ▶ Recap Meeting and Action Items | | | | | ⌚ 5 min |

Invitees: (Attendance indicated by signature)

Name:	Signature:	Name:	Signature:
Jim Minikus		John Williams	
Mary Garcia		Dennis Cisneros	
Fred Garbrecht		Gary Portwood	
Cott McDONOUGH		Paul Wood	
Yan Chenevert			
MIKE OLIVER			

Design Review Result:

- | | | |
|---|--|---|
| <input type="checkbox"/> Unconditional Approval
(No change required) | <input checked="" type="checkbox"/> Conditional Approval
(Action items must be completed) | <input type="checkbox"/> Another Design Review Required
(Redesign and conduct another design review) |
|---|--|---|

Certification:

Manager/Supervisor Signature:  Date: 12 APR 99

Peer Review

Project Information:

Page: 2

Title: 077mf15h

Number: CS-P-15

Date: March 30, 1999

Action Items:

- 1) ^{LEFT} FORGING LOCATION INCORRECT ON LAYOUT (ADJUST TO CORRECT LOCATION → REF - 03 LAYOUT)

Action Taken: Correct it to the right position

- 2) ADJUST HEEL ANGLE TO ALLOW HHEEL INSERT TO BE DRILLED ON "FLAT" SURFACE

Action Taken: ✓ did it.

- 3) VERIFY 3D CLUSTER CLEARANCES. ✓

Action Taken: 3D cluster clearance is checked, it is OK.

- 4) ADD MILLING TO NO. 1 CONE "D" ROW (MILLED FLAT)

Yes. did it.

Action Taken:

- 5) ADJUST START ANGLES ON # 1D, 1F, 2E, 3C & 3E ROWS

Yes. changed

Action Taken:

- 6) ADJUST HOLE DEPTH ON # 1E TO NON-STANDARD (HOLE DEPTH IS DEEPER THAN .280 SHOWN IN THE INSERT TABLE).

Action Taken: no need anymore since changed flat heel.

- 7) REMOVE RADIUS FROM CONE BACKFACE TO HHEEL SURFACE TRANSITION.

Yes. did it.

Action Taken:

- 8) USE S10 GRADE ON 2D ROW (GAGE)

Yes. did it.

Action Taken:

Action Items Addressed:

Project Leader's Signature: Xing Xing Date: 4-12-99

Peer Review

Project Information:

Page: 3

Title: 077mf15h

Number: CS-P-15

Date: March 30, 1999

Action Items:

9) CHANGE HEEL TO "FLAT" + "FLUSH" STYLE SIMILAR TO
PREVIOUS CUS (5630, 5680, 5743). USE $\frac{3}{16}$ " ϕ IN #1 CONE (IF
NECESSARY).

Action Taken:

yes. did it.

10) INCREASE GROOVE RADIUS ON 2C-D GROOVE.

Action Taken:

yes. did it.

Action Taken:

Action Taken:

Action Taken:

Action Taken:

Action Taken:

Action Taken:

Action Items Addressed:

Object Leader's Signature:  Date: 4-12-99



4/13/99

CONFIDENTIAL << ER TEST PLAN >> FOR INTERNAL USE ONLY <<

Number: 5754 INCOMPLETE 04/13/99 Date Revised: 04/13/99

077	Type: MF15H	Mfr: STC	EO: 23482	Project: CS-P-15	Product Type: RDF
-----	-------------	----------	-----------	------------------	-------------------

1:	BOM 2:	BOM 3:	Plant:	Project Engineer: YING	XIANG
----	--------	--------	--------	------------------------	-------

1 ER: NEW CUTTING STRUCTURE

Description:

cutting structure design based on ideas analysis tools. three gages rows on three cones are in the different locations, with different diameters, sizes, and grades. The profile is very different from existing f15h bit.

ISSUED**APR 21 1999****ENGRG. HOUSTON**

Estimated DRB Date: 00/00/00	Quantity of Runs for Rigorous Test Analysis:
------------------------------	--

Origination Date: 00/00/00	PM Prioritization Date: 00/00/00	DDQP Date: 00/00/00	EO Completion Date: 00/00/00
----------------------------	----------------------------------	---------------------	------------------------------

DISTRIBUTION OF RIGOROUS TEST BITS

District Code	District Name	Est. Production	Quantity
		00/00/00	

DESIGN OVERVIEW**Needs Comments:**

ROP from reed 51x bit

Remark Comments:

P51X and HP51XM

and Measures Comments:

The market share of f15h bit, using ideas program as tool for new cutting structure development



4/13/99

CONFIDENTIAL <<**ER TEST PLAN****>> FOR INTERNAL USE ONLY <<****ation and Lithology Comments:**

d try it first in the area where f15h standard bit drills softer formation, such as Canada, if the cutting struture holds itself, then it should be able to
sted in other tough f15h bit area.

ng Practices and Conditions Comments:

al f15h drilling practices should work for this bit

ISSUED**APR 21 1999****ENGRG. HOUSTON****SPECIFIC DESIGN CHANGES/FEATURES****ription of each Change or Feature:**

bit is total differet from our standard f15h bit in inserts counts, row counts.

ctive of each Change or Feature:

relop a bit which can compete with 51x without mud pick feature

FIELD ENGINEERING INSTRUCTIONS**ational Parameters for ER Test Comments:**

: as standard F15H and benchmark bits.

orting, Analysis, and Evaluation Requirement Comments:

onditions, wear resistance, and ROP are the most important for evaluation

Bit Return Requirement Comments:

n every bit to Houston for evaluation.

DESIGN REVIEW BOARD**al DRB Date:** 00/00/00**DRB Results:****gn Review Board Comments:**

ISSUED
2.1 1999

IG. HOUSTON

ENGINEERING ORDER
Ponca

NO. 23482
SHEET 1 OF 1

REQUESTED DATE: 4-20-99

E.R. NO. 5754

E.C.R. NO.

☐ NEW PRODUCT ☒ NEW B.O.M. NO.
☐ NEW BEARING NO. ☒ NEW PART NO.
☐ NEW FORGING NO. ☒ NEW DWG. NO.

☐ B.O.M. CHANGE
☐ PART CHANGE
☐ DWG. CHANGE

☐ FORGING CHANGE
☐ STATUS CHANGE
☒ PRODUCT REDESIGN

SIZE / TYPE 077 MF15H

BEARING NO. 525-0580

TITLE new MF15H type bit design, different from other 7-15H design.

PROJECT NO. CS-P-15

DESCRIPTION:

Create a new MF15H bit cutting structure (BOM 0024598). Three gage runs on three cones are at the different locations. #1 cone uses SRT gage insert, two and three cones use RGC type inserts.

new cone assemblies, and new cone profile & drilling are required. one new insert required (P/N 0024678), which is the same shape and dimension as part 0022626, but different grade.

finished bits are to be marked on the top of the pin and on the bit box as ER 5754, which uses as the bit type

NEW	SUPERSEDES	OLD	NEW	SUPERSEDES	OLD
0024598					

REASON: Research development Product

DISPOSITION OF AFFECTED PARTS:

DRAWING NO	REV. LTR.	DRAWING NO.	REV. LTR.	PART NO.	REV. LTR.	BOM AFFECTED	REV. LTR.
#1 Assy		204326		0024679		0024598	
#2 Assy		204327		0024680			
#3 Assy		204328		0024681			
#1 P&D		204323					
#2 P&D		204324					
#3 P&D		204325					
Insert		0024678		0024678			

PREPARED BY:

BOBBY DANIEL

APPROVED BY:

[Signature]

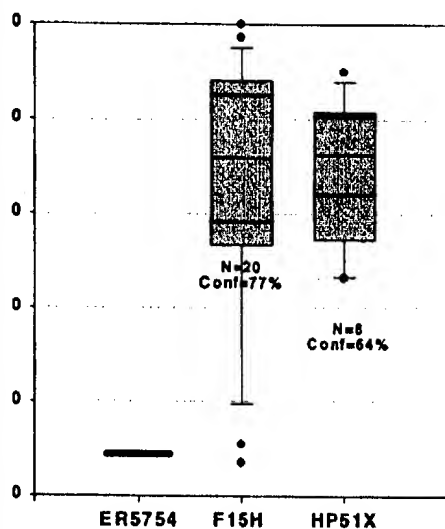
DATE: 4-20-99

CONFIGURATION
MANAGEMENT:

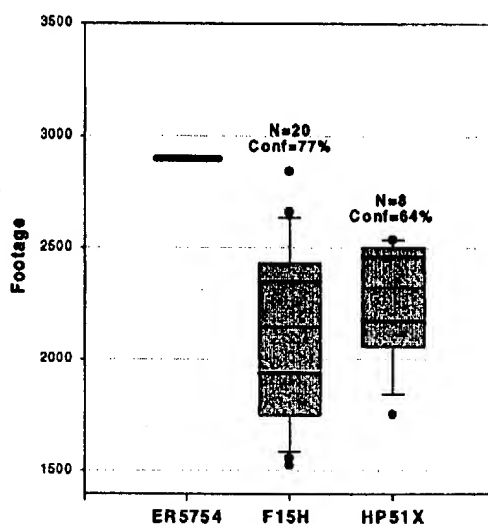
S. Schindler

11-21-99

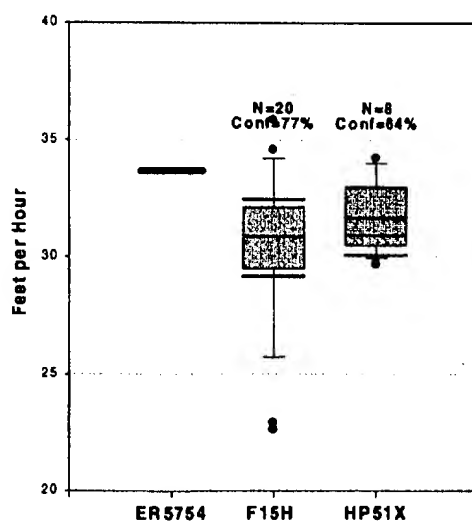
**Depth In Comparison
ER5754 - LX4911**



**Footage Comparison
ER 5754 - LX4911**



**ROP Comparison
ER5754 - LX4911**



ER5754

ER5754 came from a project named "HP51X killer" in 1999

THE FIRST IDEAS BIT

It was the first bit designed fully using IDEAS

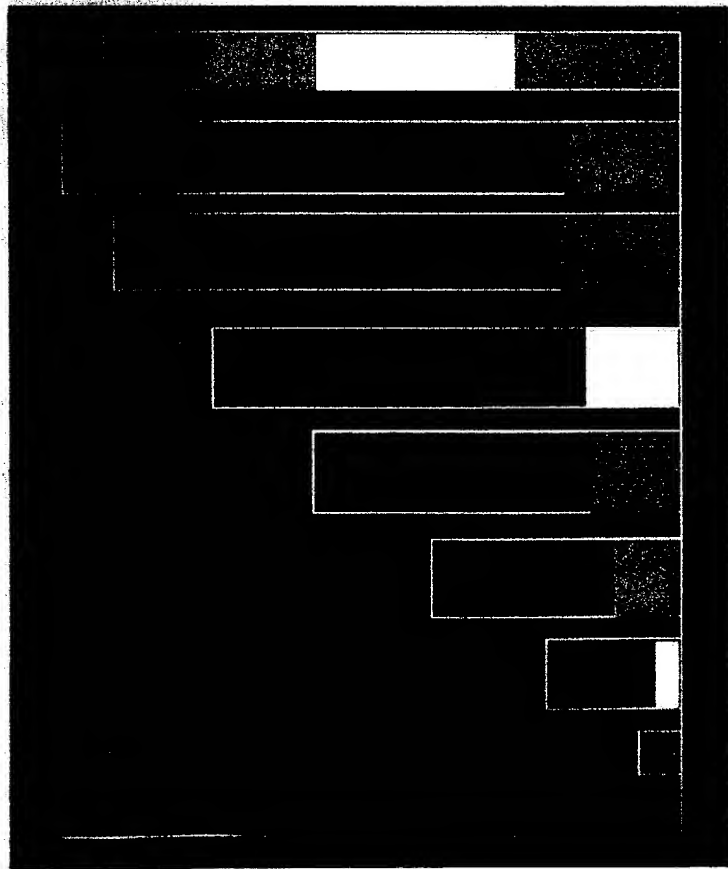
It hits homeruns in the fields of U.S. and Canada

It is also a HP53X killer

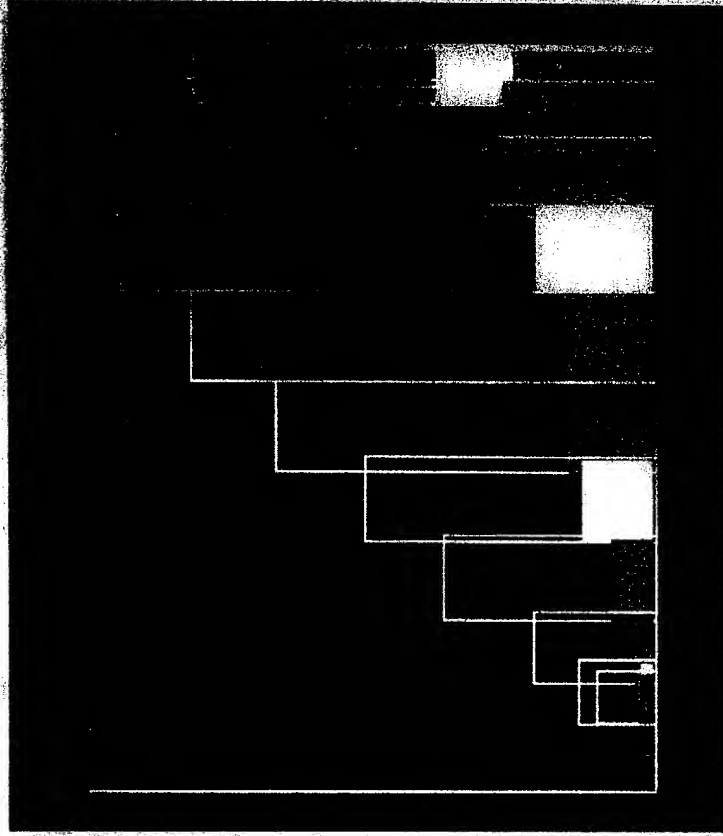


IDEAS™ Bit Design: 7 7/8 ER 5754

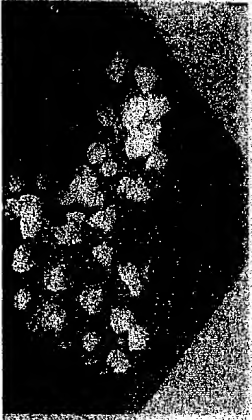
Bottom Hole Coverage Pattern



STD 7 7/8 F15H

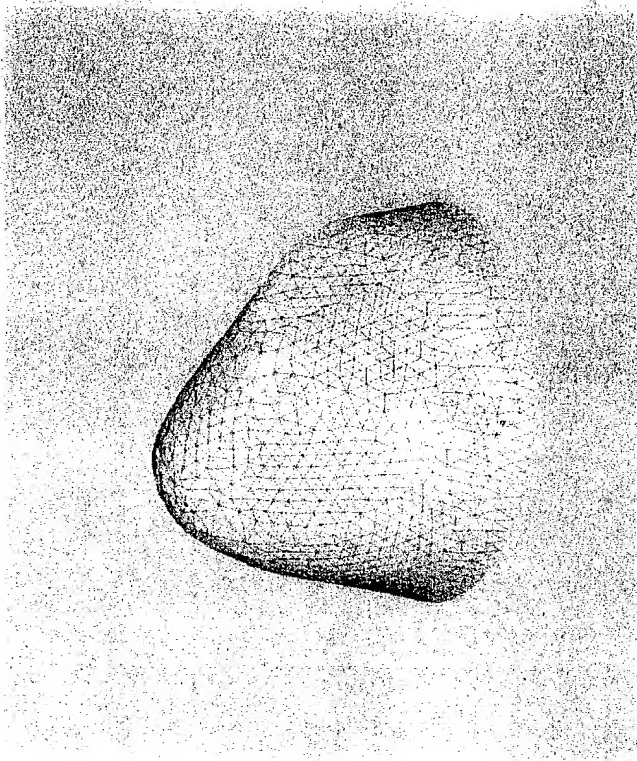
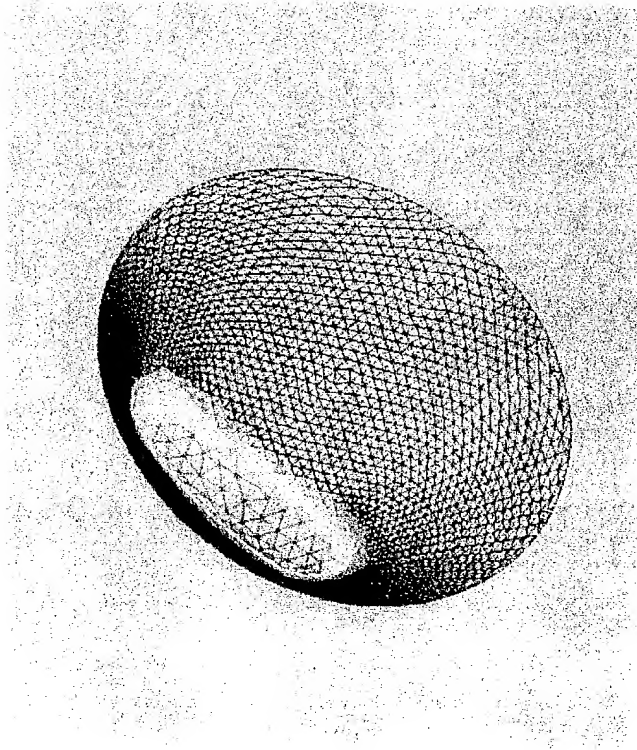


ER 5754



Bit Optimization

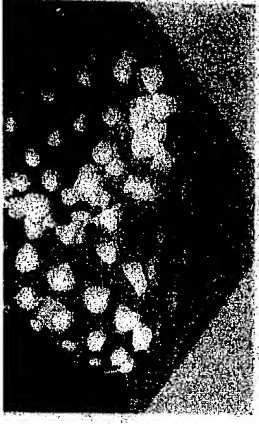
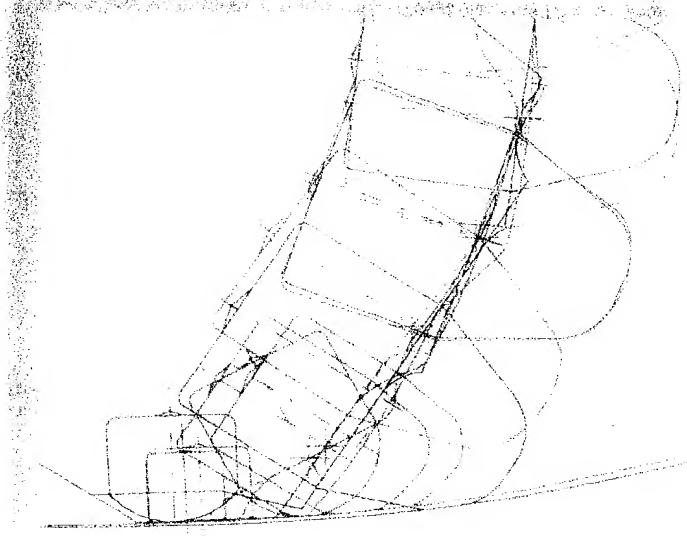
Insert Sharpness, Shape, Counts And Wear Resistance



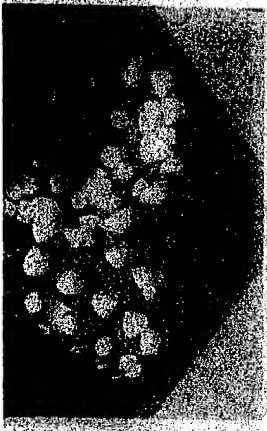
IDEAS™ Bit Design: 7 7/8 ER 5754

STD FISH ER 5754

WOB	42k	42k
RPM	85	85
Rop/ideas	23.44	38.7
Rock Type	Shale	Shale
Bit Coverage	38%	42%
Bit Offset	.188	.219
Insert Count	104	130
Row Count	11	13
Insert Ext.	.37	.38



IDEAS™ Bit Design: 7 7/8 ER5754



➤ Increased bit offset .219 vs.
.188

➤ Unique gage configuration

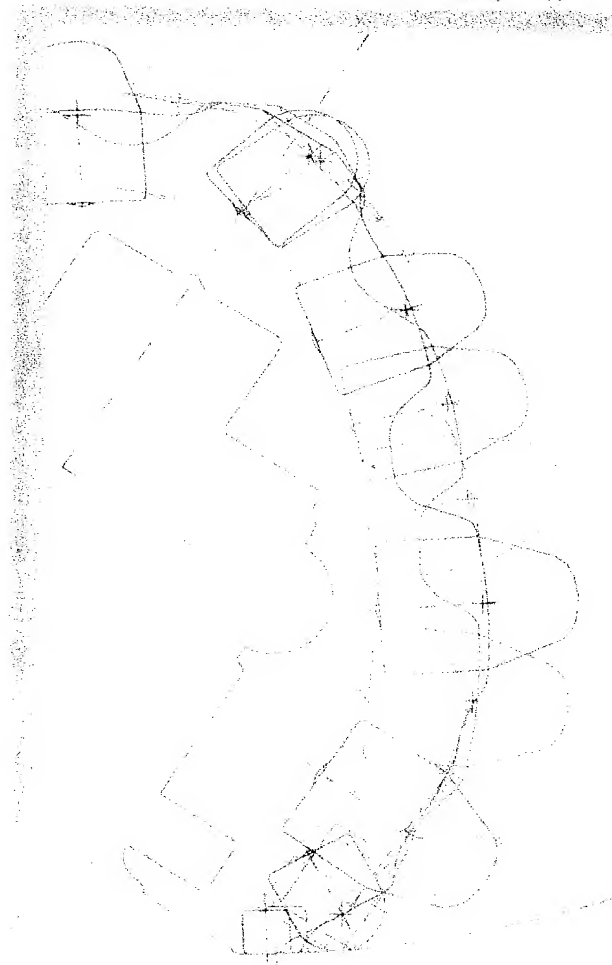
➤ Aggressive profile with
increased bottom hole
coverage

➤ Sharper inner row insert

➤ Balanced cone-bit ratios

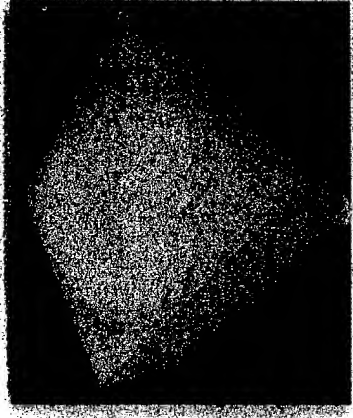
➤ Vertical force balanced

➤ Bottom hole pattern
optimization



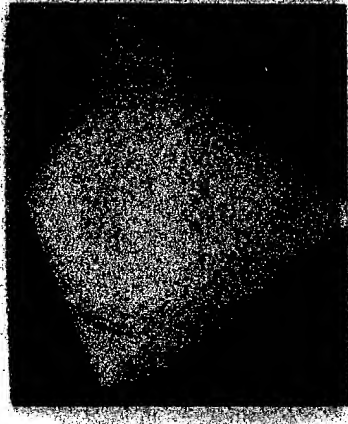
Bit Optimization

- Profile design
- Bottom hole pattern
- Insert sharpness, shape, counts and wear resistance
- Gage inserts configuration and efficiency
- General bit geometry



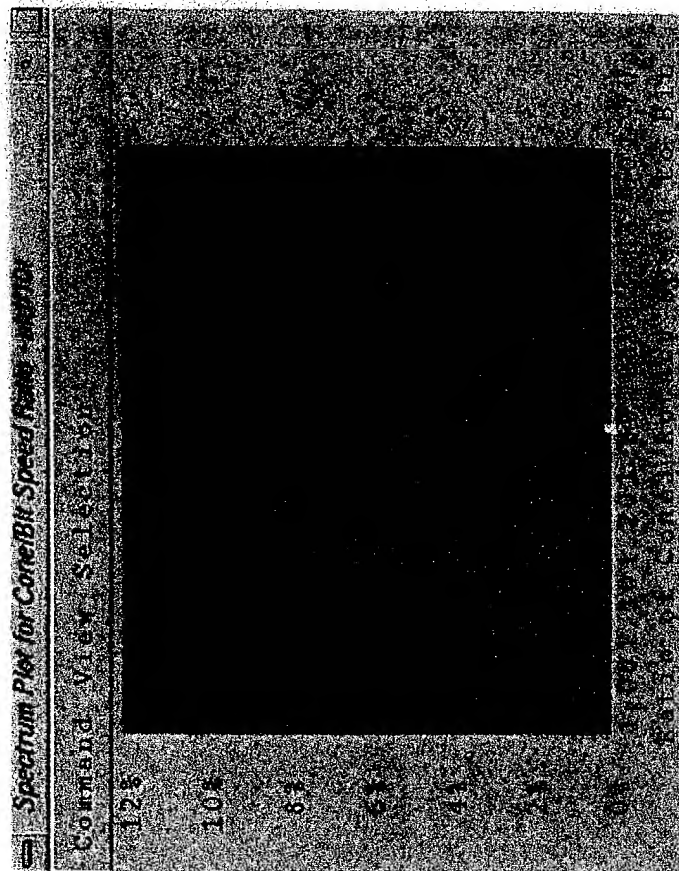
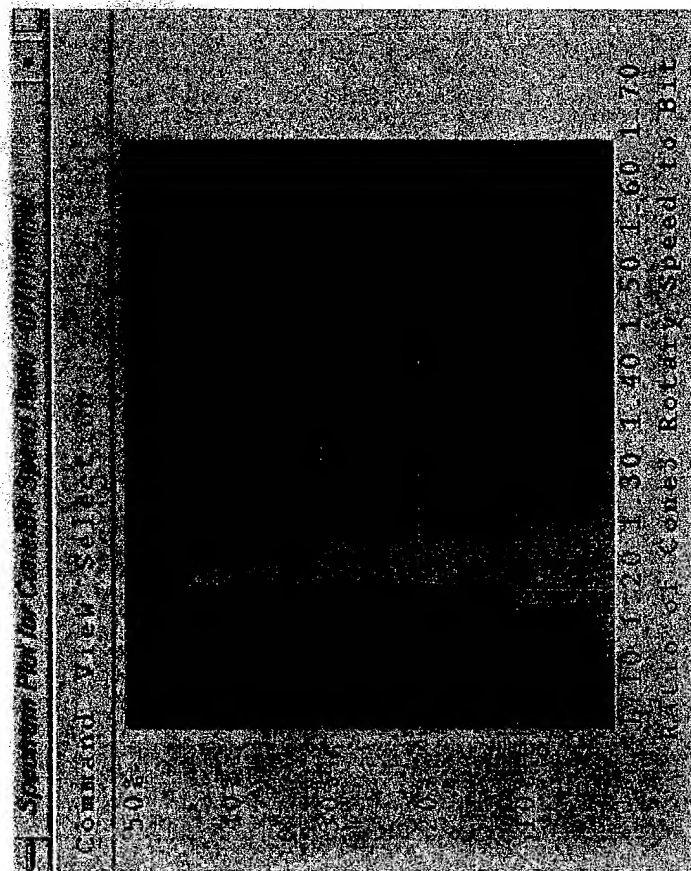
Bit Optimization

- Profile design
- Bottom hole pattern
- Insert sharpness, shape, counts and wear resistance
- Gage inserts configuration and efficiency
- General bit geometry



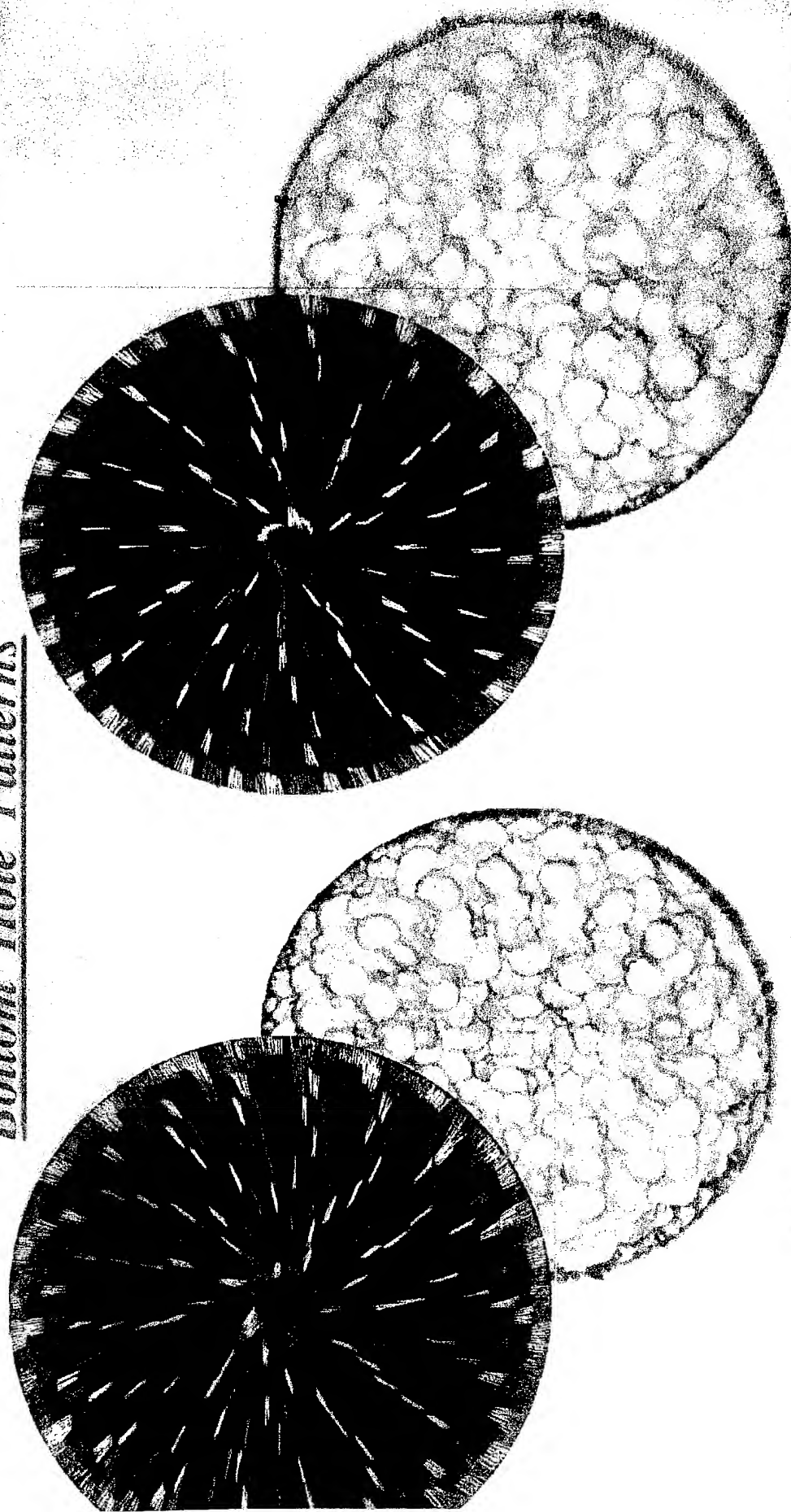
Bit Optimization

Bit/Cone Rotation Ratio



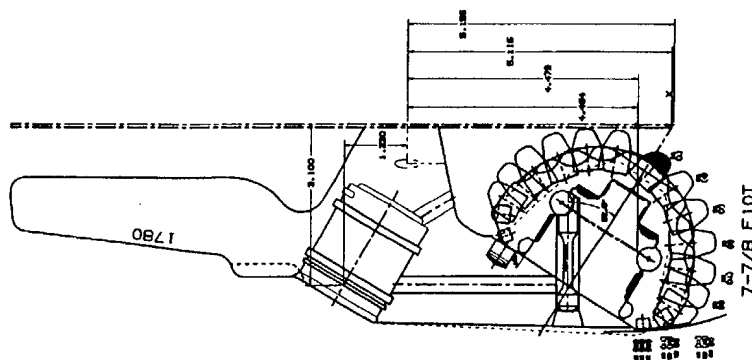
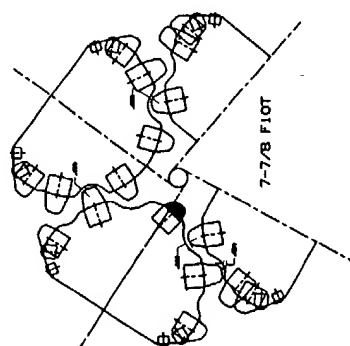
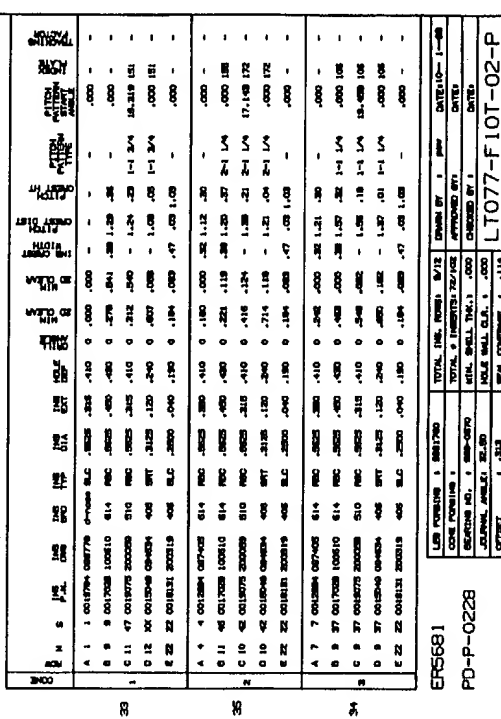
IDEAS™ Bit Design: 7 7/8 ER5754

Bottom Hole Patterns



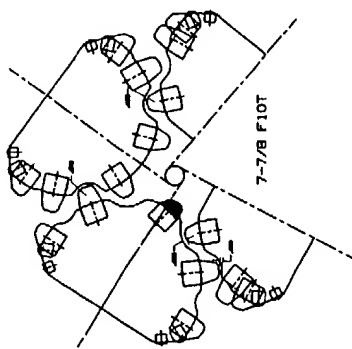
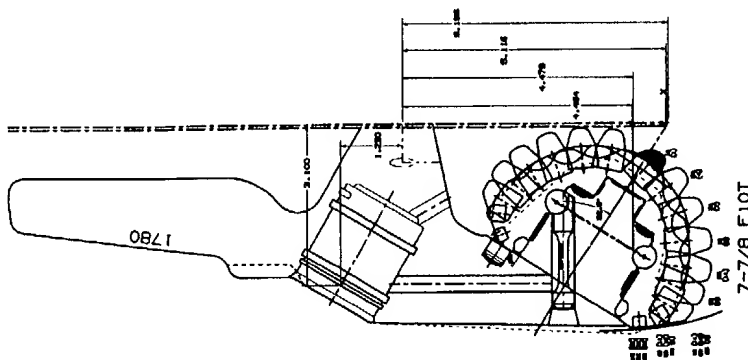
ER 5754

Standard 7 7/8 F15H



CODE	NO.	STANDARD	SPACING	MILLING CUTTER	SPECIAL INSTRUCTIONS
2	6	9	27	0" X .750 ED X .002 R	PLATE FOR HOLE-MILL AXIS 1 TO PLAT

.513	SEAL CONTAINER	.119	ENTITIES ARE CURRENT
------	----------------	------	----------------------

$$\begin{matrix} 1C & 2C & 3C \\ \{11\} & \{10\} & (9) \end{matrix}$$
[illegible]

DATE	NOV 01 1991	ENTRANCE	MILLING CUTTER	SPECIAL INSTRUCTIONS
3	0	5	27	PLATE FOR HOLEMILL AND 1 TO PLAT

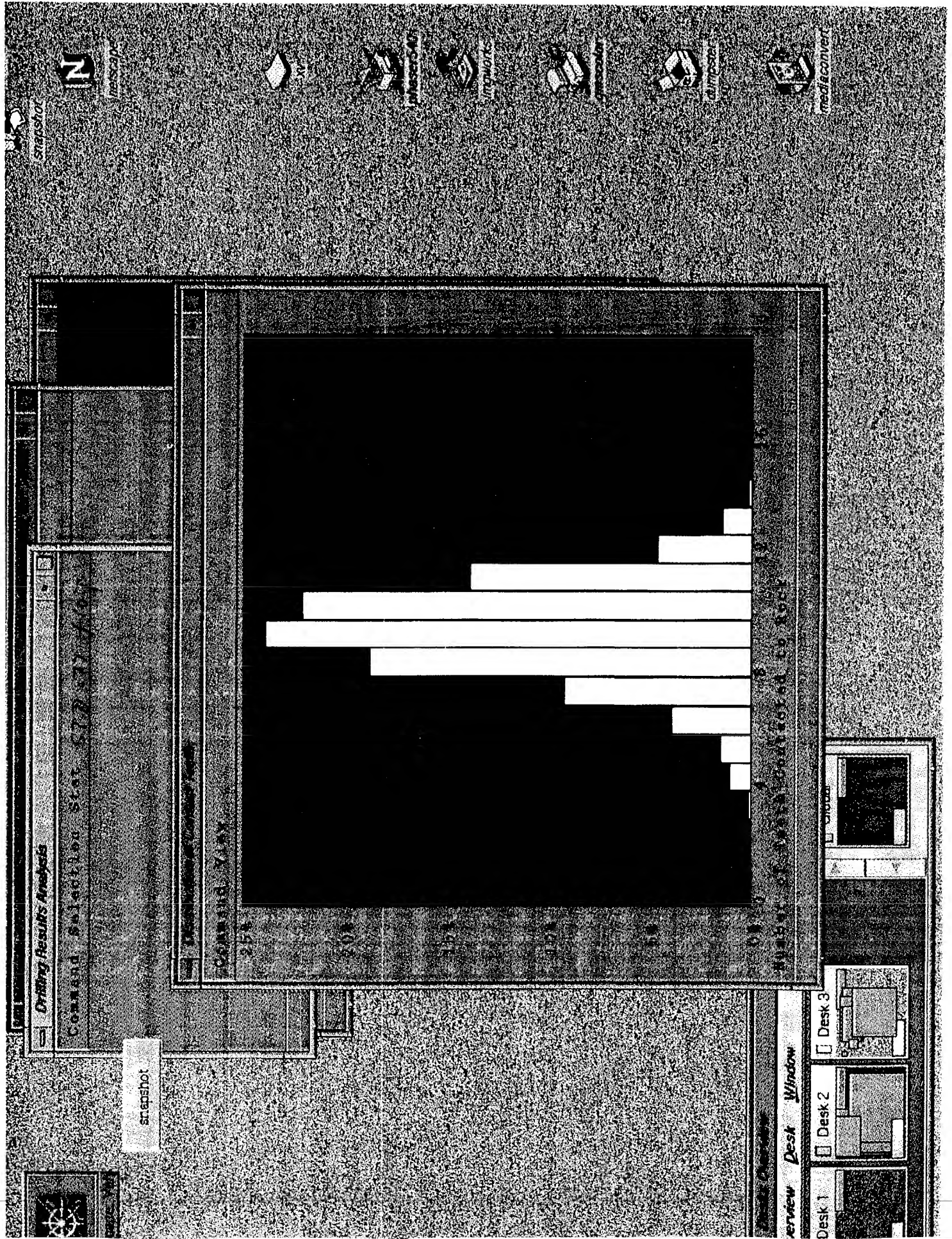
LIB FORTNAHE	5881792	TOTAL INB. POSS	9/12	DRWN BY		DATE: 10-1-80
CODE FORTNAHE		TOTAL # INHERITS 72/102		APPROVED BY		DATE
SEATING AC.	1 889-0070	MTLS. BELL. THK.	.000	CHECKED BY		DATE
JOHN AMLEY	SELED	MOLE MIL. CLP.	.000			
JOHN		REAL. COMPARE	.114			
OBJECT	.313					

LT077-F10T-02-P

FD-302a

FD-302a

DRILL/MILL ENTITIES ARE CURRENT



Drilling Results Analysis

Command Selection Set: 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000

snapshot

Command Y-Plot

254

204

154

104

54

4

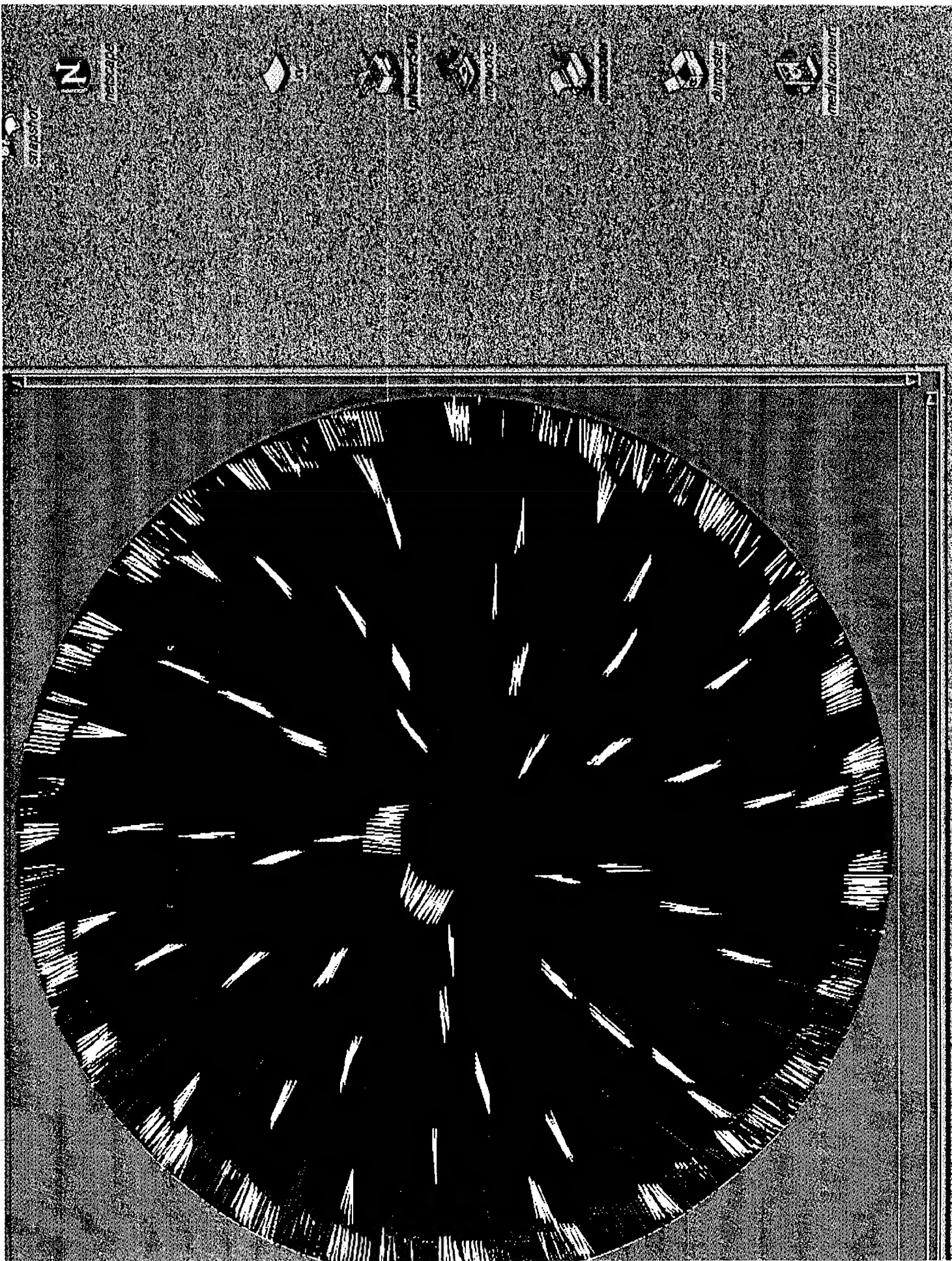
Number of shots connected to rock

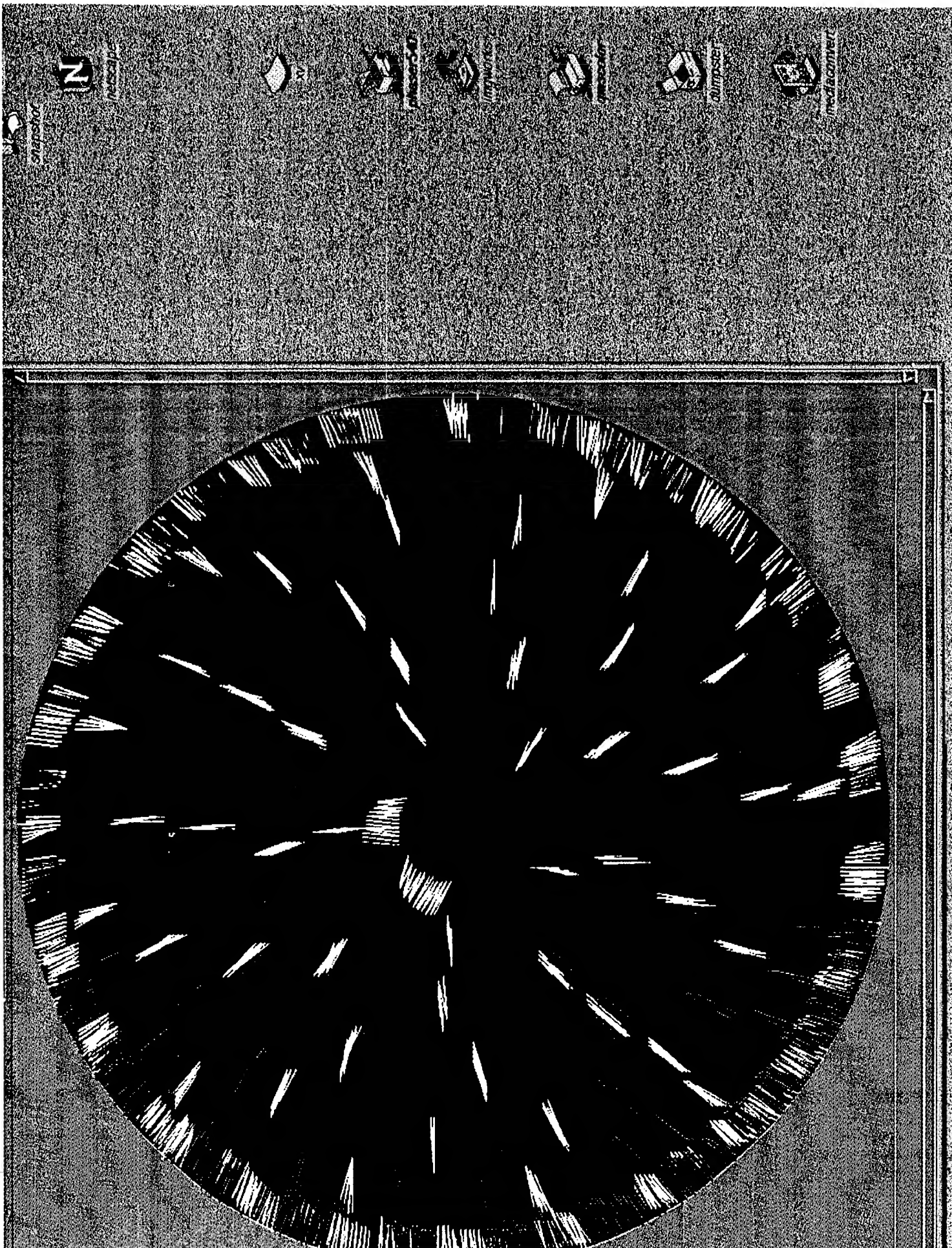
View Desk Window

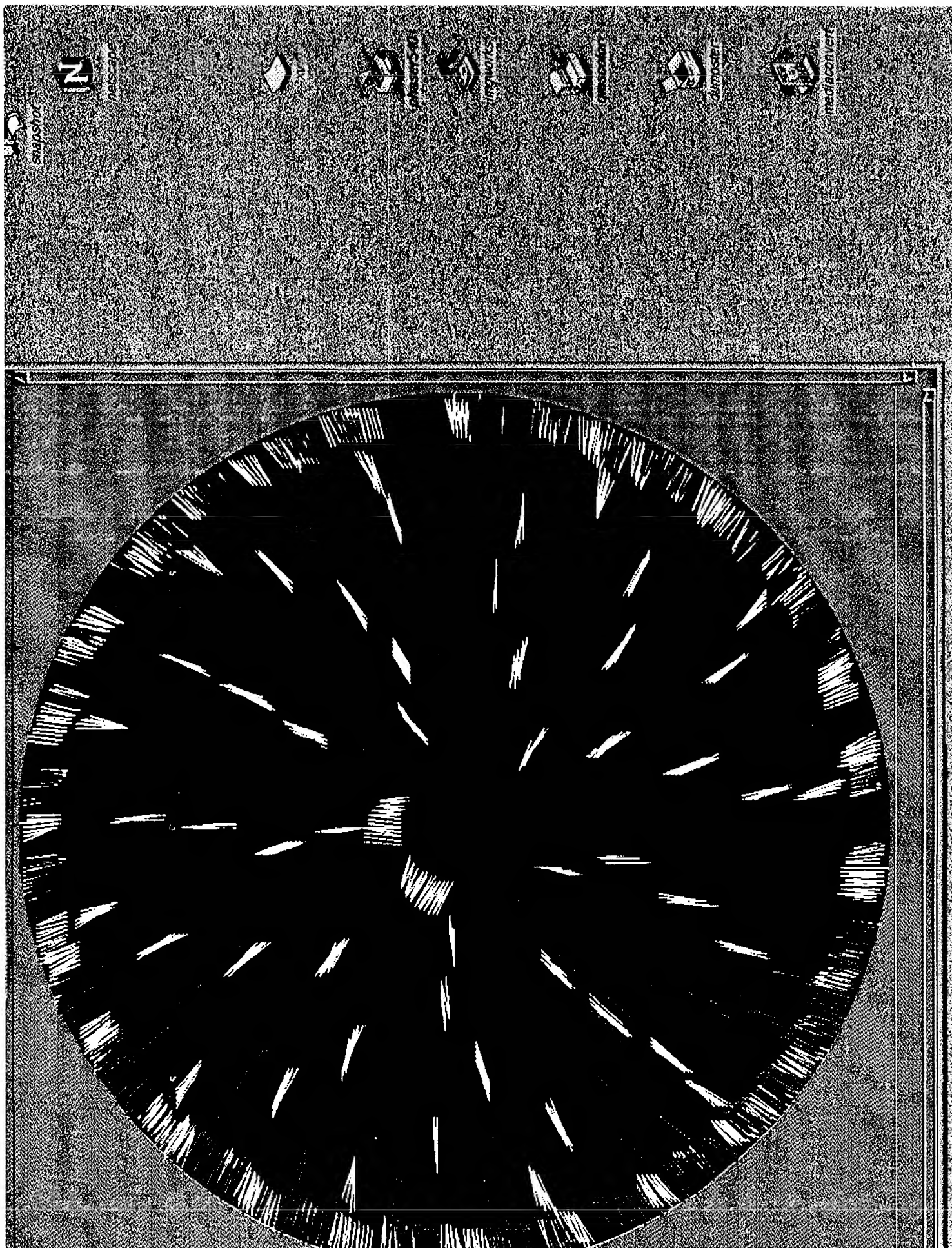
Desk 1

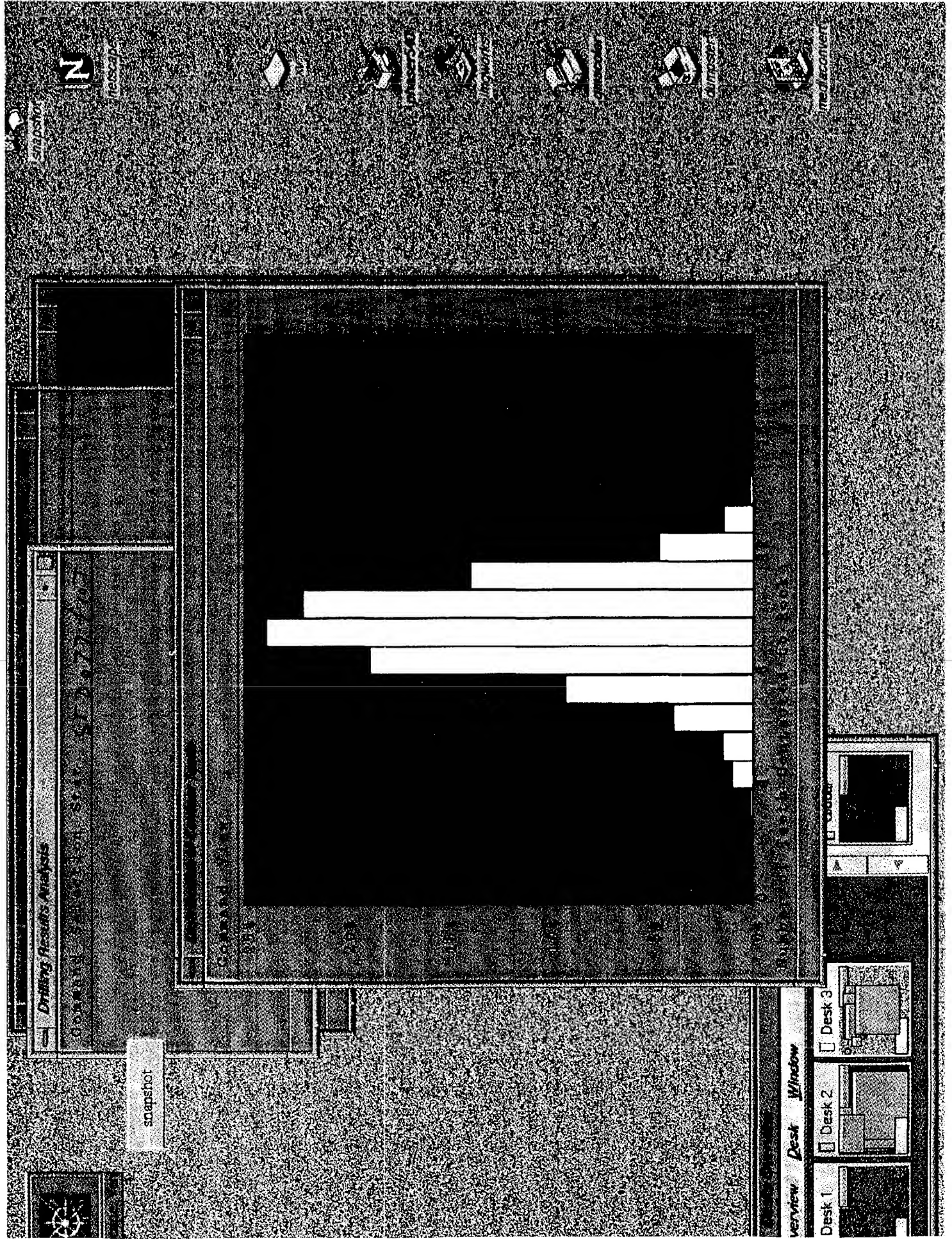
Desk 2

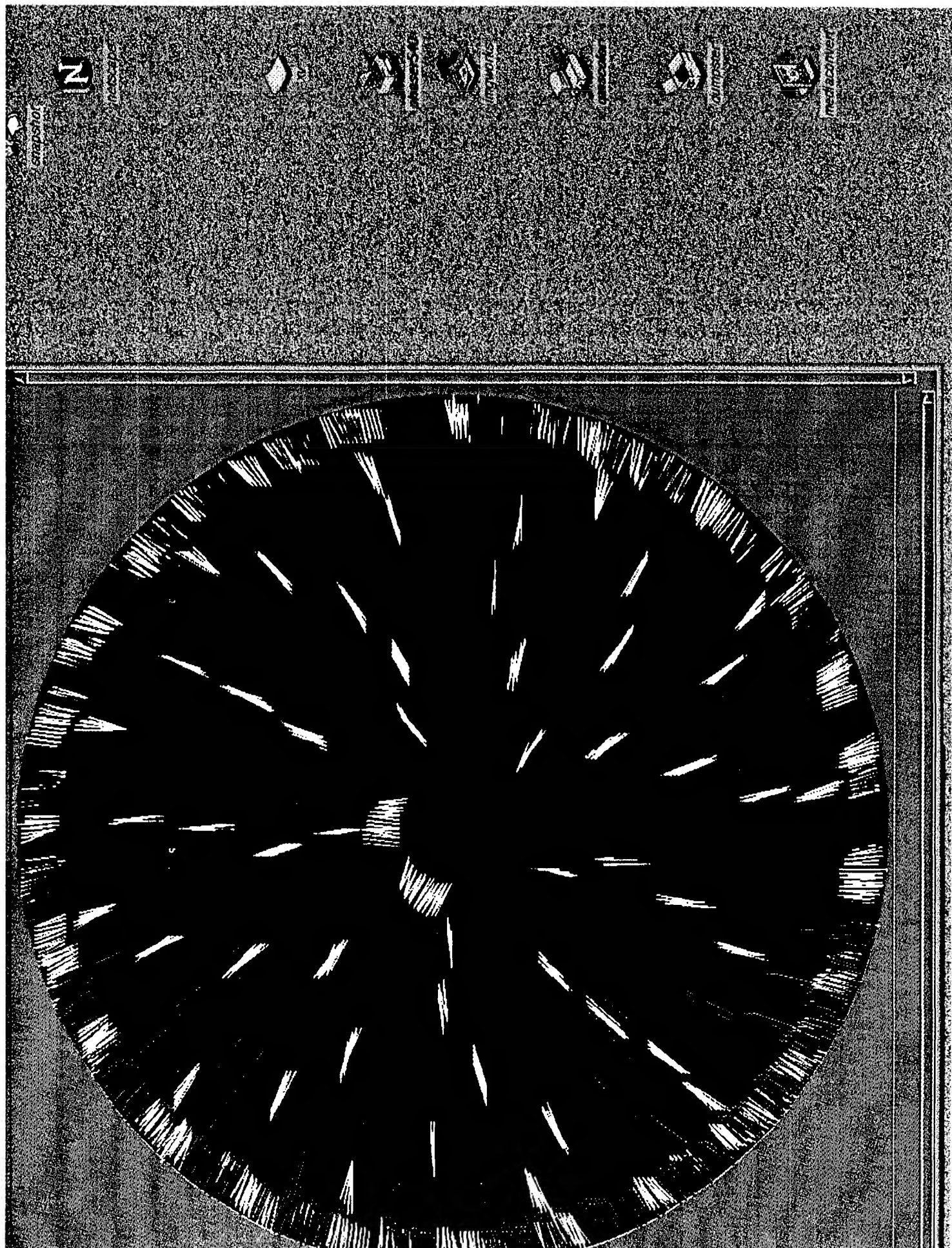
Desk 3

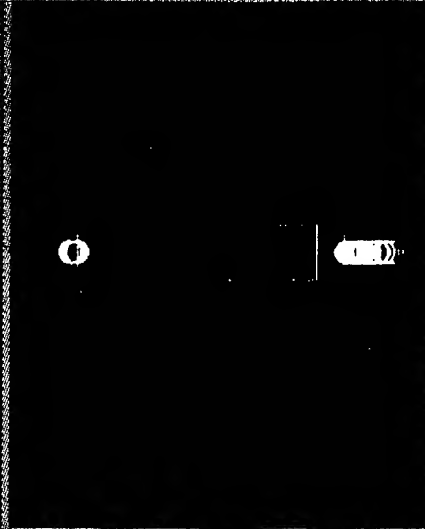




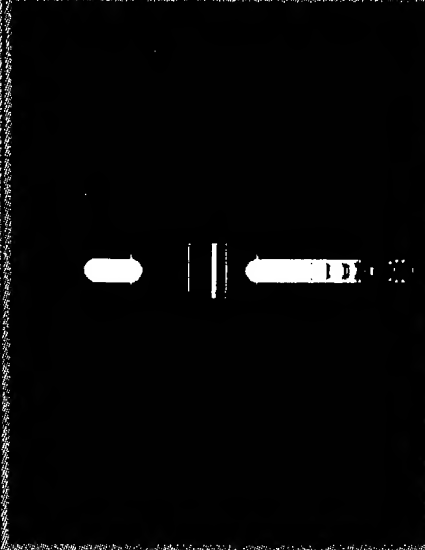




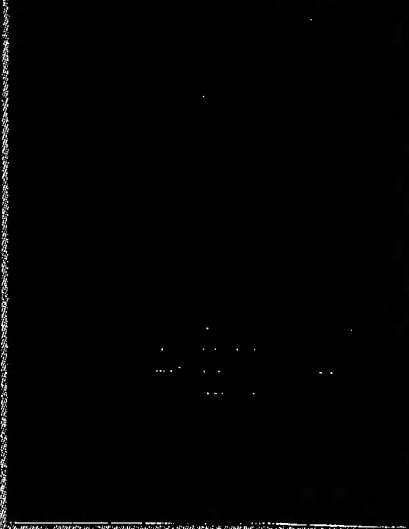




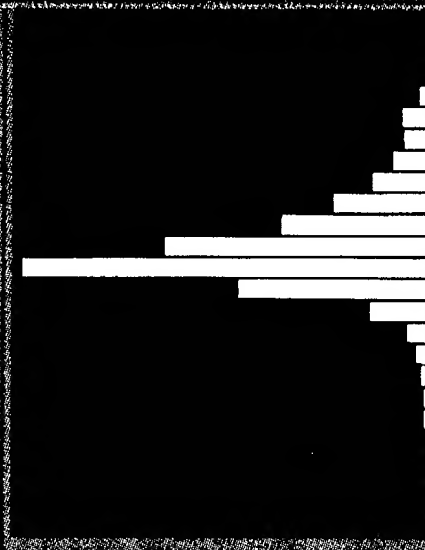
and View 361 east job



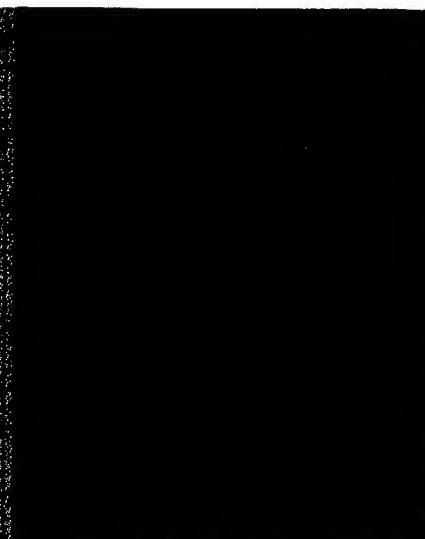
100



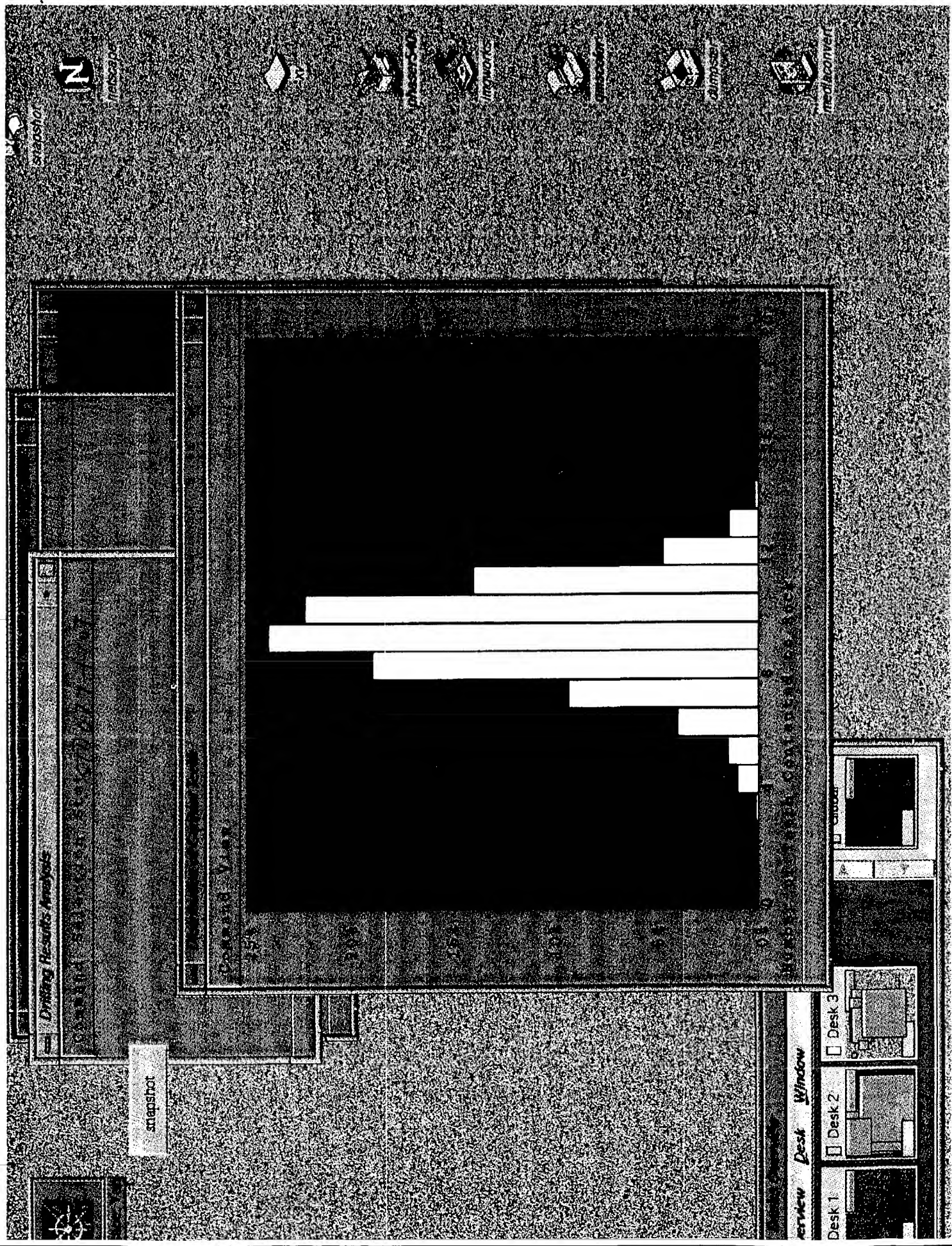
1981-1982

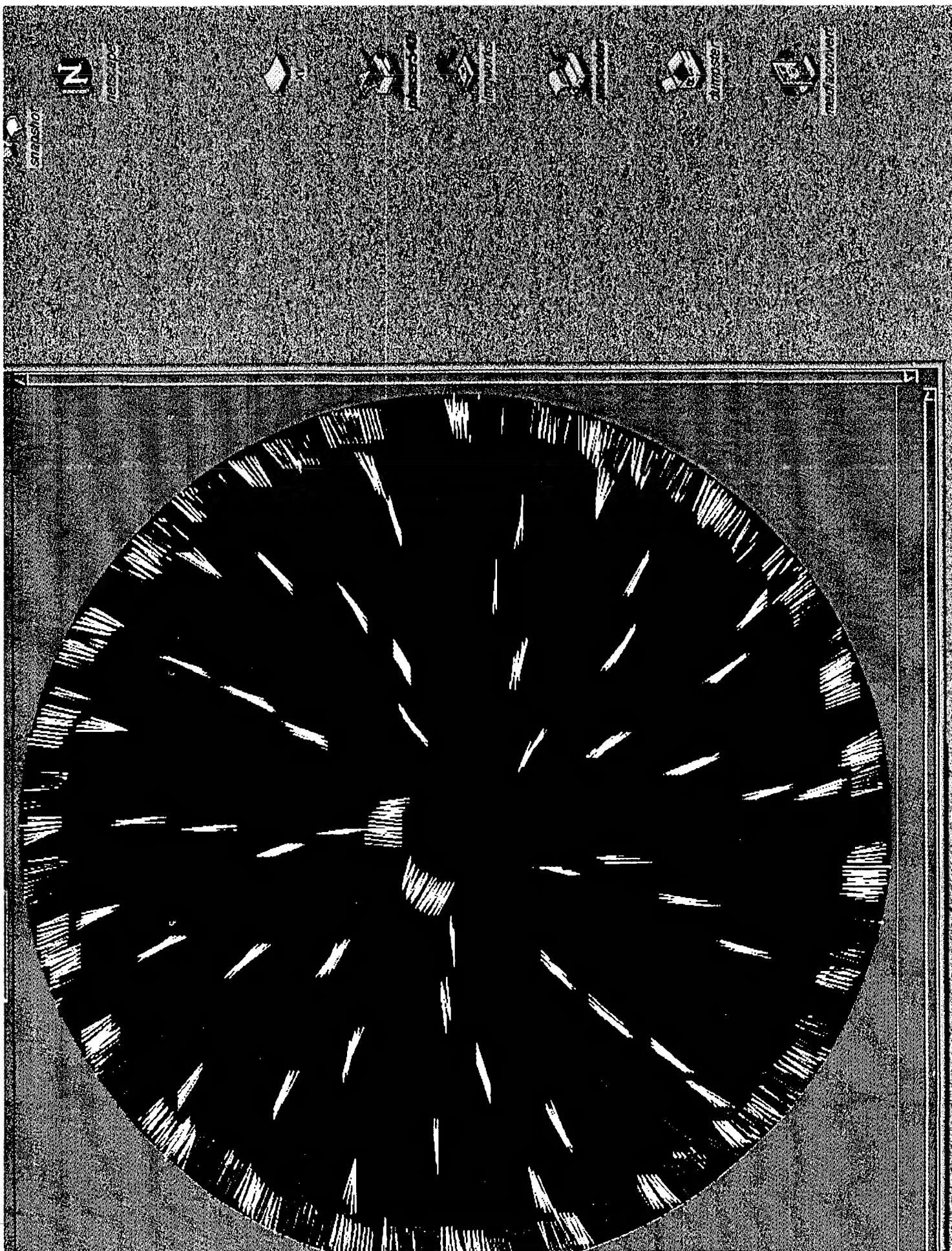


THE



1. *Chlorophyll a* and *Chlorophyll b* were determined by the method of Arar and Collins (1971) using a Shimadzu 1010 spectrophotometer. The concentration of chlorophyll was expressed in mg g⁻¹ of dry weight.

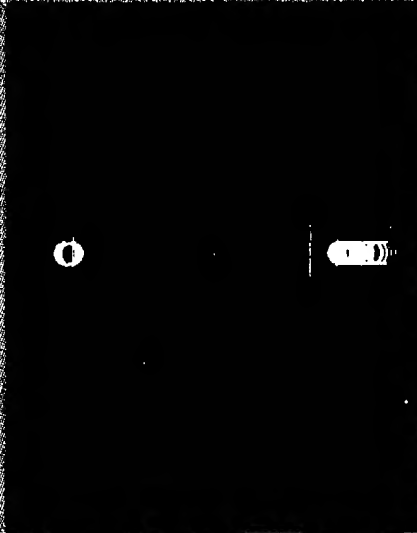




Estimated Seismicity Score: 57768774207

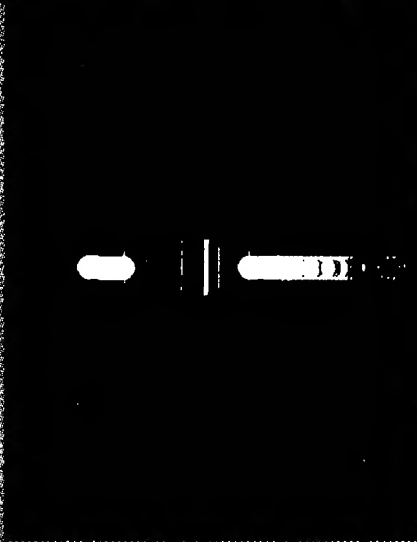
N

and View Selection



Ratio of Computed Seismicity Score

and View Selection



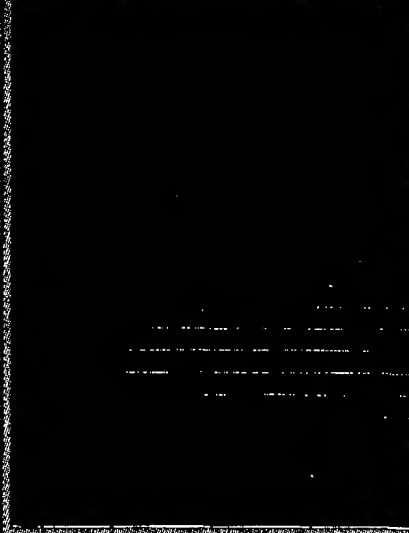
Ratio of Computed Seismicity Score

and View Selection



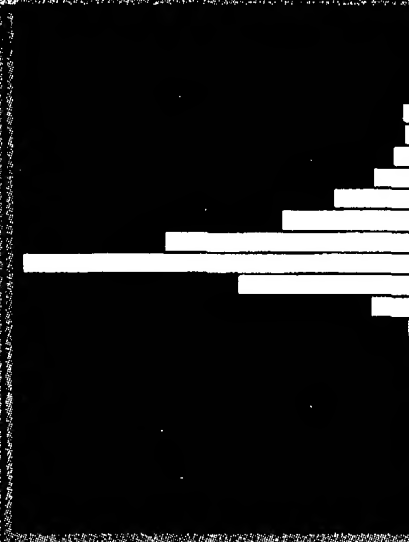
Ratio of Computed Seismicity Score

and View Selection



Ratio of Computed Seismicity Score

and View Selection

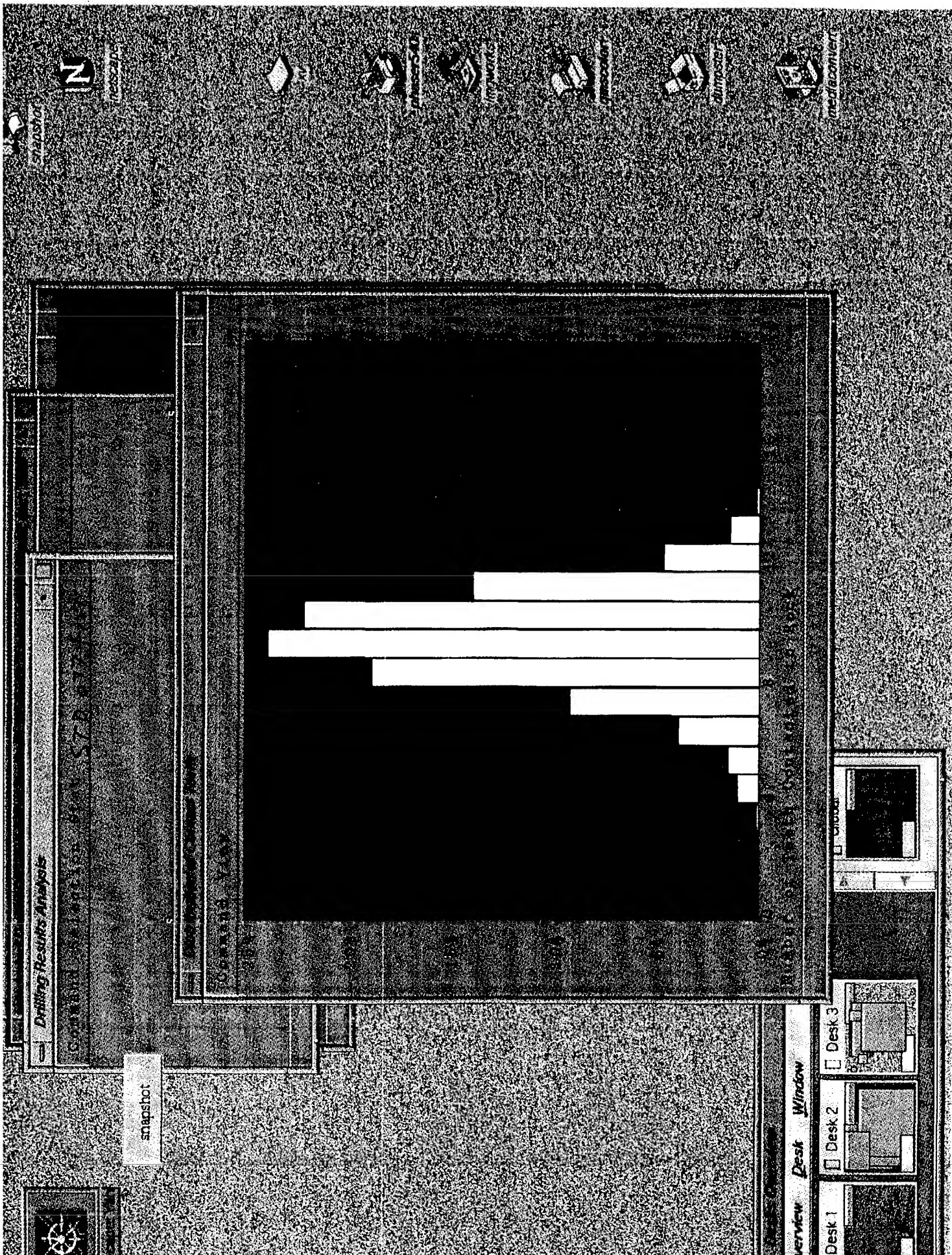


Ratio of Computed Seismicity Score

and View Selection



Ratio of Computed Seismicity Score



AS Calculation Summary

Subject: /users/ps9978/projfl0t(offsetf10t)
 Diameter of Bit: 7.87 (in) [200 (mm)]
 Weight on Bit: 42000 (lbf) [19051 (kgf)]
 Rotations per minute: 170 (rpm)
 Rotations of Simulated: 30 (rev)
 Coefficient of Rock-shell contact: 1
 Hole area: 48.707 (sq.in)

offset

.375

CutArea Coverage (sq.in) %

21.29	43.70
16.90	34.69
17.62	36.17
18.42	37.82
18.69	38.38
19.16	39.34
18.78	38.55
20.28	41.63
19.38	39.78
19.55	40.15
19.25	39.52
19.68	40.41
17.85	36.66
19.17	39.36
19.07	39.16
18.16	37.29
18.46	37.91
19.47	39.97
17.41	35.74
19.70	40.44
20.02	41.10
18.61	38.20
17.42	35.77
18.70	38.39
17.05	35.00
19.61	40.25
19.62	40.28
19.37	39.77
19.82	40.68
19.88	40.81

Range of Coverage for Bit: 38.90 %

Range of Coverage for Each Row:

Row	Rmin (in)	Rmax (in)	C.Avr (sq.in)	CovI %	CovA %
1	3.852	3.937	0.002	0.07	0.00
2	3.696	3.937	0.177	3.05	0.36
3	3.162	3.937	1.950	11.28	4.00
4	1.684	2.658	2.765	20.82	5.68
5	0.232	0.896	0.186	7.91	0.38
1	3.865	3.937	0.003	0.17	0.01
2	3.716	3.937	0.150	2.83	0.31
3	3.139	3.937	1.841	10.37	3.78
4	2.299	3.277	3.582	20.91	7.35
5	0.429	1.377	0.984	18.31	2.02
1	3.865	3.937	0.002	0.09	0.00
2	3.704	3.937	0.126	2.24	0.26
3	3.154	3.936	2.060	11.83	4.23
4	2.791	3.707	2.531	13.53	5.20
5	1.122	1.996	2.060	24.07	4.23

Penetration Depth 0.285 (ft) [87 (mm)]
 ve fit ROP 85.48 (ft/h) [26.05 (m/h)]
 arage Penetration Depth 0.253 (ft)
 arage ROP 86.13 (ft/h)

ie	Row	Fz_max	Fz_median	Fz_aver	Counts	Angle
		27.921	9.409	9.789		
	1	0.043	0.001	0.002	22	0.00
	2	0.507	0.015	0.036	11	0.00
	3	13.478	1.738	2.335	11	0.00
	4	24.115	6.980	7.451	9	0.00
	5	7.583	0.790	1.235	1	0.00
		33.017	15.419	15.681		
	1	0.102	0.001	0.003	22	0.00
	2	0.606	0.015	0.035	10	0.00
	3	12.631	2.089	2.755	10	0.00
	4	31.227	9.346	10.067	11	0.00
	5	13.728	3.925	4.008	4	0.00
		30.458	15.388	15.383		
	1	0.071	0.001	0.003	22	0.00
	2	0.542	0.011	0.030	9	0.00
	3	13.085	2.813	3.330	9	0.00
	4	17.166	5.811	5.826	9	0.00
	5	22.570	6.945	7.075	7	0.00
	6	1.179	0.294	0.355	1	0.00

e	Row	Insert Forces	Fx_aver	Fy_aver	Fz_aver
	1		0.110	0.004	0.002
	2		0.631	0.041	0.025
	3		0.728	0.118	1.457
	4		0.210	0.074	5.501
	5		0.134	0.238	1.238
	1		0.104	0.005	0.003
	2		0.598	0.037	0.027
	3		0.582	0.117	1.837
	4		0.183	0.066	6.462
	5		0.196	0.047	3.720
	1		0.122	0.006	0.003
	2		0.585	0.036	0.025
	3		0.488	0.119	2.367
	4		0.122	0.097	4.923
	5		0.189	0.075	5.552
	6		0.042	0.161	0.359

io of Cone Rotary Speed to Bit:

e Ratio
 1.2201
 1.3316
 1.3274

aping Brittle File Size 1476096 (bytes)
 tical Brittle File Size 13683936 (bytes)
 ll Contacted Times 2021 (times)
 tact Percentage of Shell to Rock 56.1389 %

AS Calculation Summary

ject: ./.offsetf10t
 eter of Bit: 7.87 (in) [200 (mm)]
 yht on Bit: 42000 (lbf) [19051 (kgf)]
 olutions per minute: 85 (rpm)
 olutions of Simulated: 30 (rev)
 Efficient of Rock-shell contact: 1
 ehole area: 48.707 (sq.in)

CutArea Coverage

(sq.in) %

21.29 43.70
 16.90 34.69
 17.62 36.17
 18.42 37.82
 18.69 38.38
 19.16 39.34
 18.78 38.55
 20.28 41.63
 19.38 39.78
 19.55 40.15
 19.25 39.52
 19.68 40.41
 17.85 36.66
 19.17 39.36
 19.07 39.16
 18.16 37.29
 18.46 37.91
 19.47 39.97
 17.41 35.74
 19.70 40.44
 20.02 41.10
 18.61 38.20
 17.42 35.77
 18.70 38.39
 17.05 35.00
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 19.62 40.28
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 19.82 40.68
 19.88 40.81

range of Coverage for Bit: 38.90 %

range of Coverage for Each Row:

Row	Rmin (in)	Rmax (in)	C.Avr (sq.in)	CovI %	CovA %
1	3.852	3.937	0.002	0.07	0.00
2	3.696	3.937	0.177	3.05	0.36
3	3.162	3.937	1.950	11.28	4.00
4	1.684	2.658	2.765	20.82	5.68
5	0.232	0.896	0.186	7.91	0.38
1	3.865	3.937	0.003	0.17	0.01
2	3.716	3.937	0.150	2.83	0.31
3	3.139	3.937	1.841	10.37	3.78
4	2.299	3.277	3.582	20.91	7.35
5	0.429	1.377	0.984	18.31	2.02
1	3.865	3.937	0.002	0.09	0.00
2	3.704	3.937	0.126	2.24	0.26
3	3.154	3.936	2.060	11.83	4.23
4	2.791	3.707	2.531	13.53	5.20
5	1.122	1.996	2.060	24.07	4.23
6	0.343	0.658	0.039	3.92	0.08

Penetration Depth 0.285 (ft) [87 (mm)]
 ve fit ROP 42.74 (ft/h) [13.03 (m/h)]
 rage Penetration Depth 0.253 (ft)
 rage ROP 43.07 (ft/h)

Row	Fz_max	Fz_median	Fz_aver	Counts	Angle
	27.921	9.409	9.789		
1	0.043	0.001	0.002	22	0.00
2	0.507	0.015	0.036	11	0.00
3	13.478	1.738	2.335	11	0.00
4	24.115	6.980	7.451	9	0.00
5	7.583	0.790	1.235	1	0.00
	33.017	15.419	15.681		
1	0.102	0.001	0.003	22	0.00
2	0.606	0.015	0.035	10	0.00
3	12.631	2.089	2.755	10	0.00
4	31.227	9.346	10.067	11	0.00
5	13.728	3.925	4.008	4	0.00
	30.458	15.388	15.383		
1	0.071	0.001	0.003	22	0.00
2	0.542	0.011	0.030	9	0.00
3	13.085	2.813	3.330	9	0.00
4	17.166	5.811	5.826	9	0.00
5	22.570	6.945	7.075	7	0.00
6	1.179	0.294	0.355	1	0.00

Row	Insert Forces	Fx_aver	Fy_aver	Fz_aver
1		0.110	0.004	0.002
2		0.631	0.041	0.025
3		0.728	0.118	1.457
4		0.210	0.074	5.501
5		0.134	0.238	1.238
1		0.104	0.005	0.003
2		0.598	0.037	0.027
3		0.582	0.117	1.837
4		0.183	0.066	6.462
5		0.196	0.047	3.720
1		0.122	0.006	0.003
2		0.585	0.036	0.025
3		0.488	0.119	2.367
4		0.122	0.097	4.923
5		0.189	0.075	5.552
6		0.042	0.161	0.359

io of Cone Rotary Speed to Bit:

Ratio
 1.2201
 1.3316
 1.3274

aping Brittle File Size 1476096 (bytes)
 tical Brittle File Size 13683936 (bytes)
 ll Contacted Times 2021 (times)
 tact Percentage of Shell to Rock 56.1389 %

Desktop Selected Internet Find System CAD Hardcopy Sniff Help

Snapshot

EA5879

071 f107 final

Snapshot

ps978



Netscape

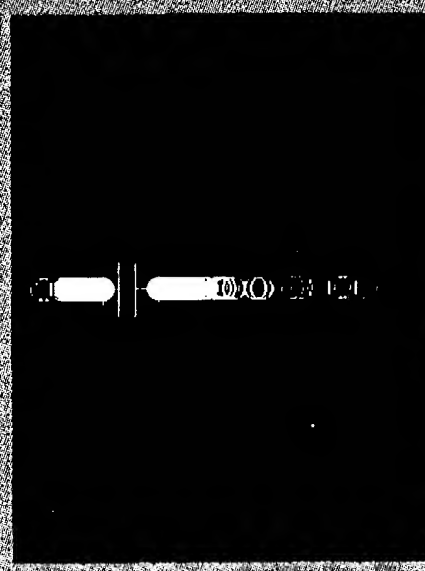
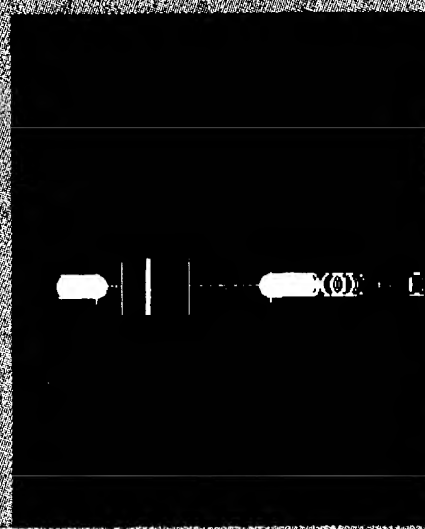
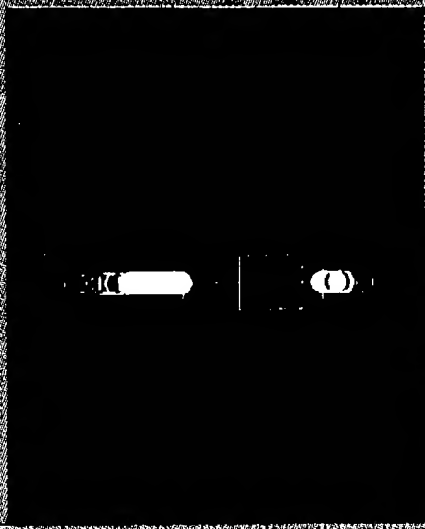
Desktop Selected Internet Find System CAD Hardcopy Sniff Help

Command View Selection Stat

Command View Selection

Command View Selection

Command View Selection



Ratio of Cone2 Rotary Speed

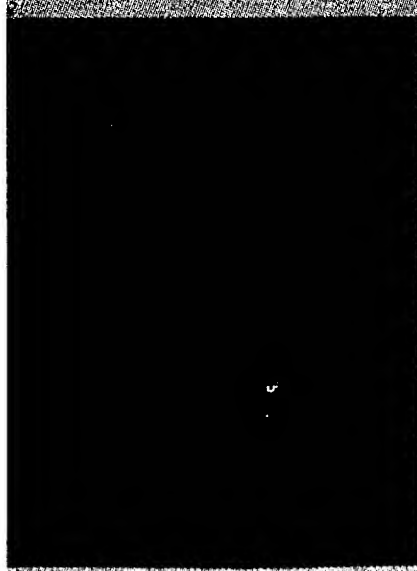
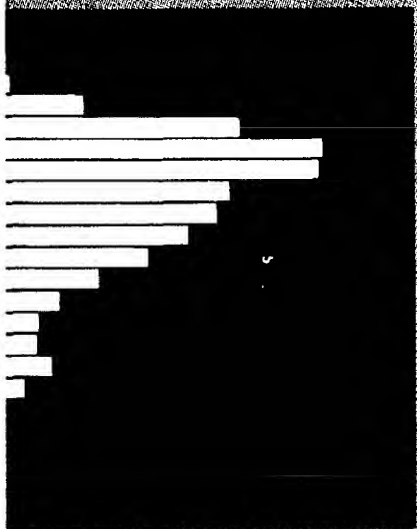
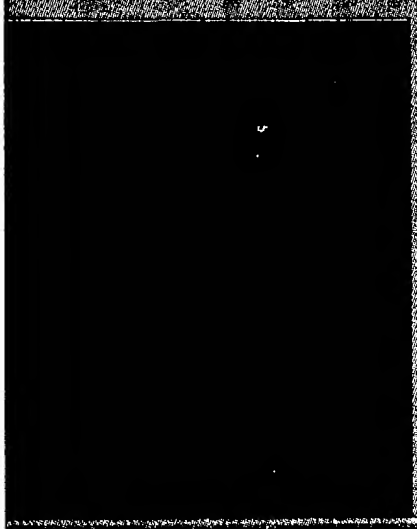
Ratio of Cone2 Rotary Speed

Ratio of Cone3 Rotary Speed

Command View Selection

Command View Selection

Command View Selection



snapshot

Desktop Selected Internet Find System CAD Hardcopy Staff Help

snapshot

ps978



netscape



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phaser540



imgworks



quattro



dimpster



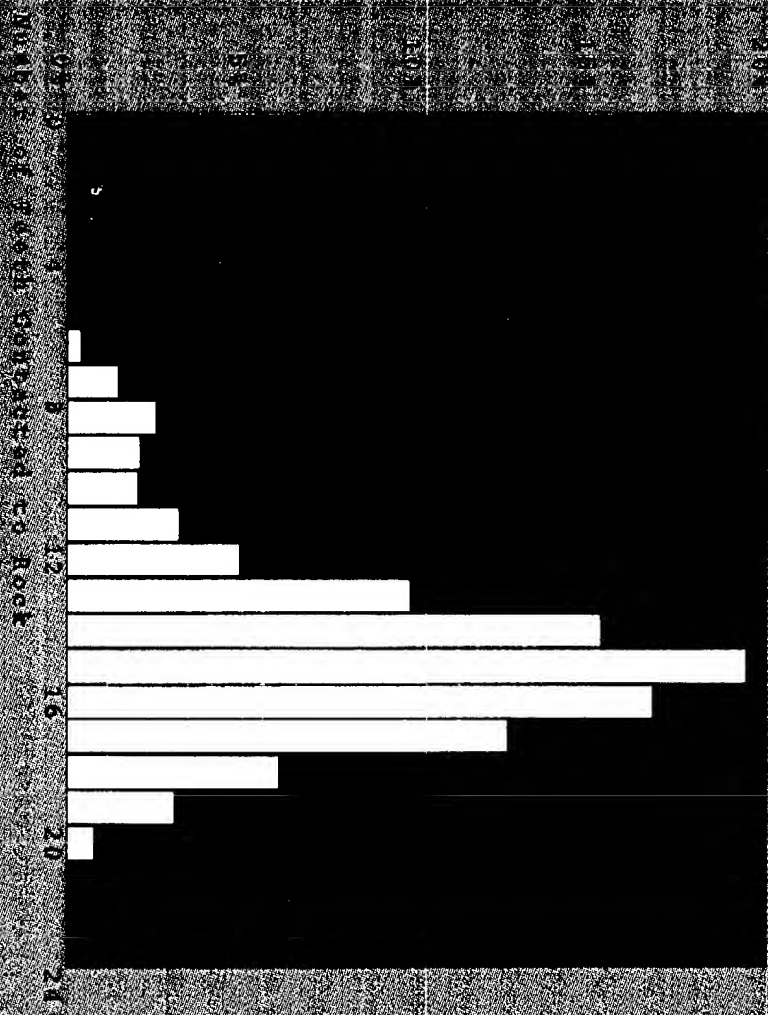
mediaconvert



Compass

FR5879
927 4107 final

Compass



Overview Desk Window

Desk 1

Desk 2

Desk 3

Global

Open Display, No Rotation

Command Window: Snapshots

snapshot

ER 5879

077 flat find

Find System CAD Hardcopy Staff Help

ps3978



netscape



snapshot



Phase 3.40



inquisits



qinsokol

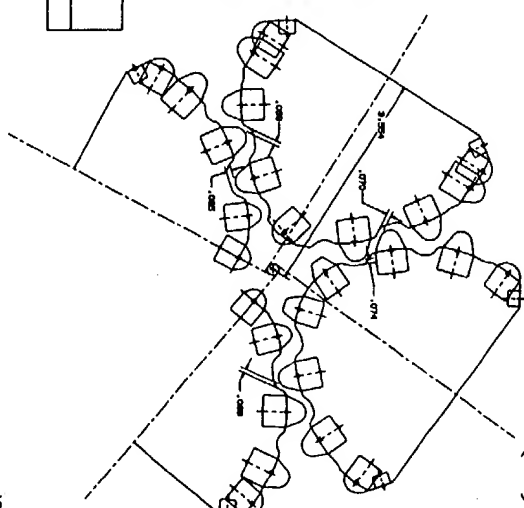


climpster



mediacconvert

c77 ER 5897



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2	FOR			
3	20-25 30-35 40-45 50-55 60-65 70-75 80-85 90-95 100-105 110-115 120-125 130-135 140-145 150-155 160-165 170-175 180-185 190-195 200-205 210-215 220-225 230-235 240-245 250-255 260-265 270-275 280-285 290-295 300-305 310-315 320-325 330-335 340-345 350-355 360-365 370-375 380-385 390-395 400-405 410-415 420-425 430-435 440-445 450-455 460-465 470-475 480-485 490-495 500-505 510-515 520-525 530-535 540-545 550-555 560-565 570-575 580-585 590-595 600-605 610-615 620-625 630-635 640-645 650-655 660-665 670-675 680-685 690-695 700-705 710-715 720-725 730-735 740-745 750-755 760-765 770-775 780-785 790-795 800-805 810-815 820-825 830-835 840-845 850-855 860-865 870-875 880-885 890-895 900-905 910-915 920-925 930-935 940-945 950-955 960-965 970-975 980-985 990-995 1000-1005 1010-1015 1020-1025 1030-1035 1040-1045 1050-1055 1060-1065 1070-1075 1080-1085 1090-1095 1100-1105 1110-1115 1120-1125 1130-1135 1140-1145 1150-1155 1160-1165 1170-1175 1180-1185 1190-1195 1200-1205 1210-1215 1220-1225 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EPC897

LES GRS IS SAUF AS 4904-0511 EXCEPT
HMS A. 112ER ON BELL H.O.D. TUBS "0841"

[illegible]

DRILL/MILL ENTITIES ARE CURRENT

Project Edit

Calculation

Simulation

Drilling Results Analysis

Command Selection Stat

ER5879

07741074.mad

Snapshot

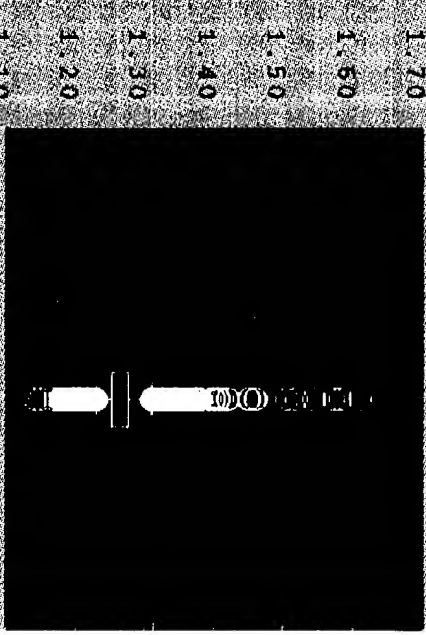
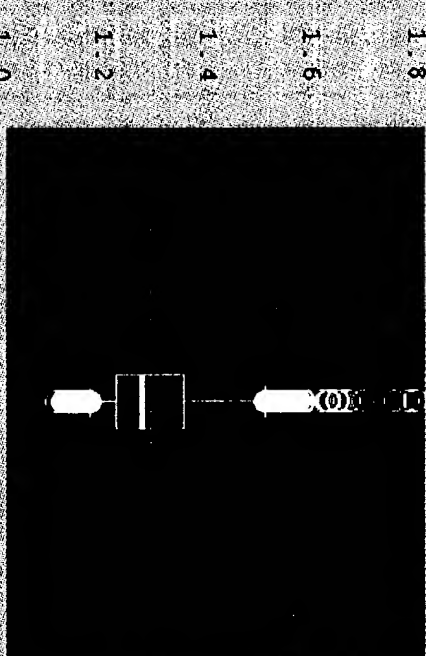
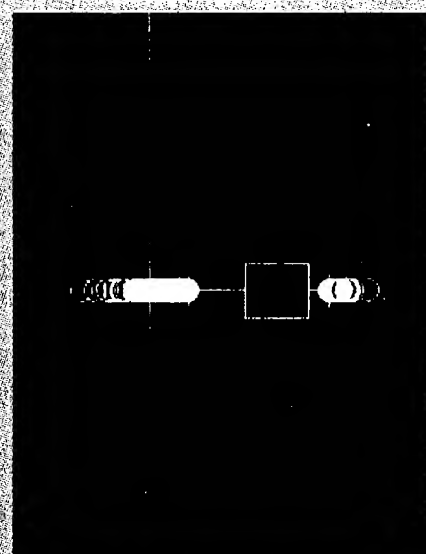


Netscape

Project Edit
Calculation
Simulation
Command View Selection

Project Edit
Calculation
Simulation
Command View Selection

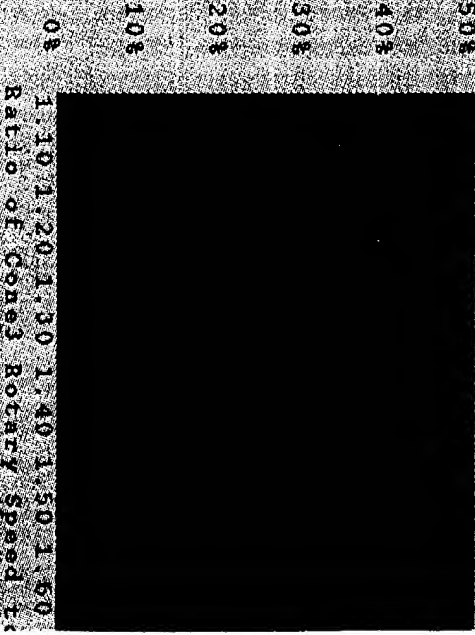
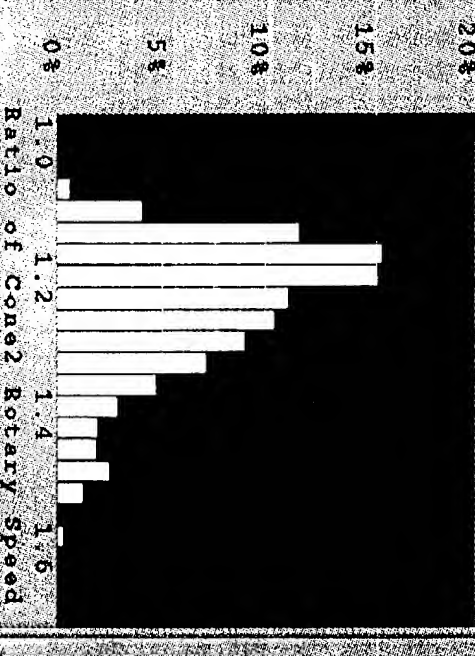
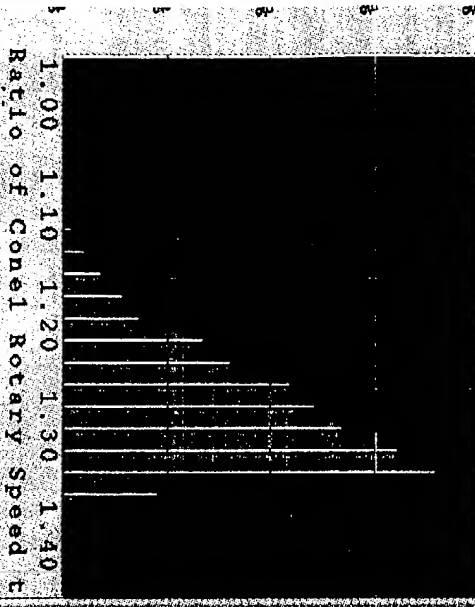
Project Edit
Calculation
Simulation
Command View Selection



Project Edit
Calculation
Simulation
Command View Selection

Project Edit
Calculation
Simulation
Command View Selection

Project Edit
Calculation
Simulation
Command View Selection



Find System CAD Hardcopy Staff Help

03/97



netscape



snapshot



VW



Picaso540



imageworks



QIRSCOLOR



clumpster

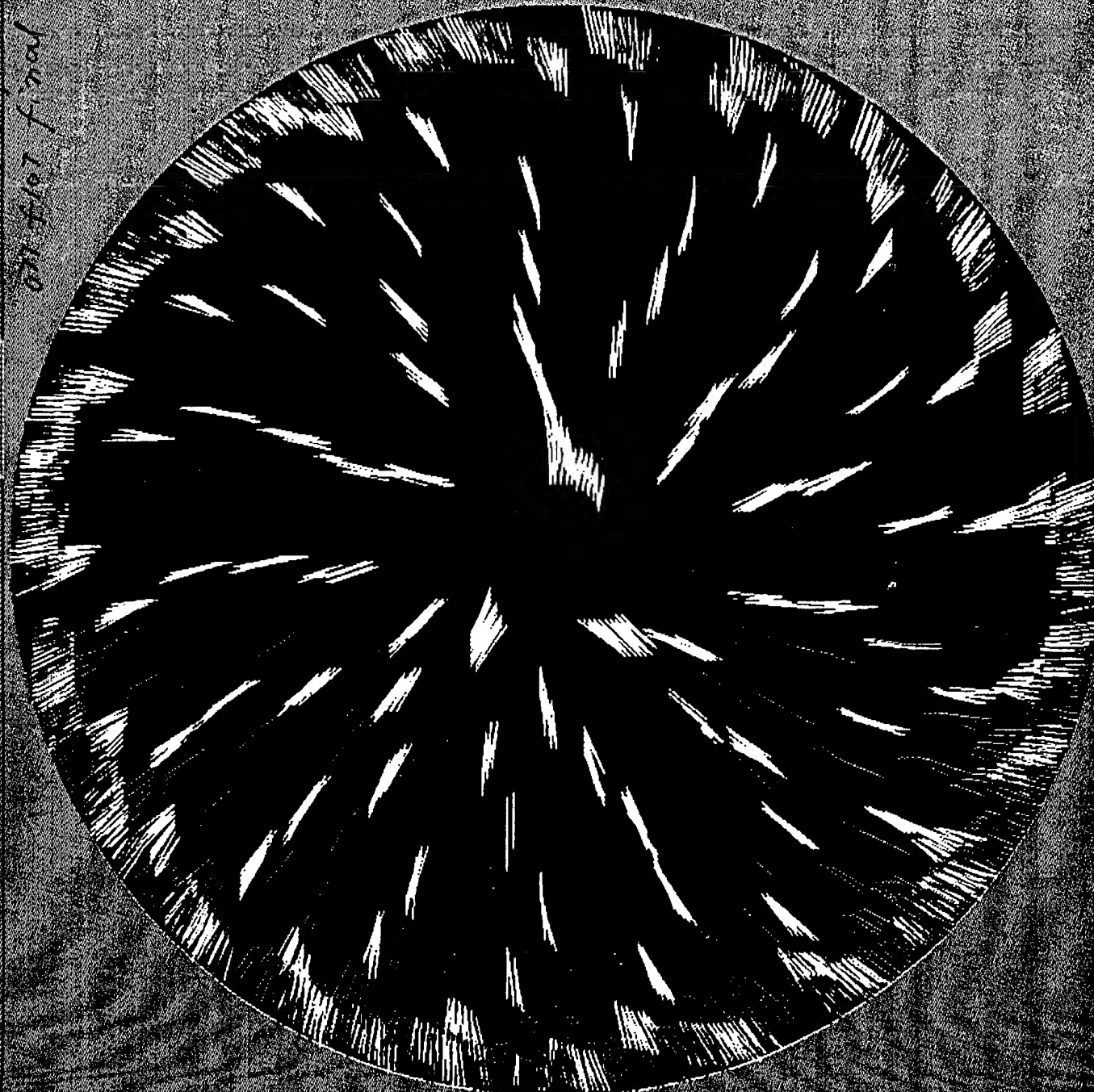


mediaconvert

FR55879

on 4/107 final

snapshot



Peer Review

Project Information:

Page: 1

Title: 077f10t

Number: cs-p-15

Leader(s): YING XIANG

Meeting Schedule:

Date: Feb. 10, 2000

Time: 9.00 a.m.

Place: room 2002

Meeting Objectives:

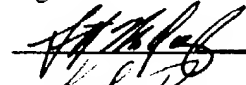
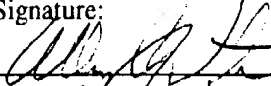
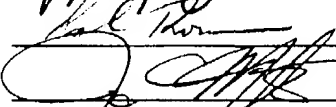
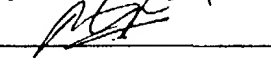
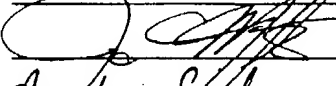
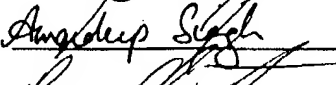
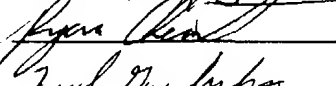
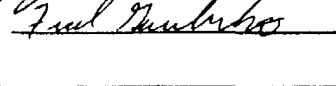
077 F10t cutting structure design review

Agenda Topics

Time Allotment

▶ Review Product Brief	<input checked="" type="checkbox"/> PDP	<input type="checkbox"/> ECR	<input type="checkbox"/> CAR	<input type="checkbox"/> EPA	⌚ 10
▶ information from the field					⌚ 10 min
▶ Review new design					⌚ 45 min
▶ open discuss					⌚ 15 min
▶					⌚
▶					⌚
▶ Recap Meeting and Action Items					⌚ 5 min

Invitees: (Attendance indicated by signature)

Name:	Signature:	Name:	Signature:
SCOTT McDONOUGH		ALLEAN WATSON	
Karl Rose		Prabha Kar Centala	
JIM MINIKUS			
AMAR SINGH			
LIAN CHEEVERT			
Fred Garbrecht			

Design Review Result:

<input type="checkbox"/> Unconditional Approval (No change required)	<input type="checkbox"/> Conditional Approval (Action items must be completed)	<input type="checkbox"/> Another Design Review Required (Redesign and conduct another design review)
---	---	---

Verification:

Manager/Supervisor Signature: _____ Date: _____

Peer Review

Project Information:

Page: 2

Title: 077F10t

Number: CS-P-15

Date: Feb. 10, 2000

Action Items:

short the existing bearing sleeve. put bullet seal,
mud bug system on the bit.

Action Taken:

name it f10 in system
ER number for field.

Action Taken:

Action Taken:

Action Taken:

Action Taken:

Action Taken:

Action Taken:

Action Taken:

Action Items Addressed:

Project Leader's Signature: _____ Date: _____

SMITH TOOL

ENGINEERING ORDER

No.: 24017

Sheet 1 of 1

Location: PONCA

PROJECT/ECR NO.: CS-P-15	E.R. NO.: 5897
SIZE/TYPE: 077 F10T	BEARING NO.: 525-0540
TITLE: IDEALS BIT DESIGN	

DESCRIPTION:

CREATED A NEW BOM FOR 077 F10T TYPE BIT

BIT FEATURES:

- 1.) THIS NEW BIT CUTTING STRUCTURE IS DESIGNED TO GAIN HIGHER ROP - BETTER DULL CONDITION BY USING IDEALS SA CUTTING STRUCTURE ANALYSE TOOL.
- 2.) NO TRUE CUT FEATURE - ROW COUNT, INSERT COUNT ARE OPTIMIZED TO ACHIEVE HIGHER ROP.
- 3.) TWO NEW INNER ROW INSERTS - THREE DIFFERENT GAGE ROW INSERTS WITH DIFFERENT DIA. - DIFFERENT LOCATIONS ALONG GAGE CURVE.
- 4.) THIS BIT ALSO FEATURES A NEW BRG WITH BULLET SEAL SIMILAR TO BRG 525-0580.

ISSUED

MAR 08 2000

ENGRG. HOUSTON

PART #	REV.	DRAWING #	REV.	PART # SUPERCEDED	DRAWING # SUPERCEDED	DESCRIPTION
0026557						BOM FOR 077 F10T TYPE BIT NEW
0026848		205380				CONE 1 077 F10T ASSY NEW
0026849		205381				CONE 2 077 F10T ASSY NEW
0026850		205382				CONE 3 077 F10T ASSY NEW
		205376				CONE 1 077 F10T PROF. & DRILL NEW
		205377				CONE 2 077 F10T PROF. & DRILL NEW
		205378				CONE 3 077 F10T PROF. & DRILL NEW
		205388				CONE BRG DETL. NEW
0026854		205383				LEG MACH DETL. NEW
		205384				JRNL MACH DETL NEW
		205385				JRNL FINISH DETL NEW
		205386				LEG REMILL DETL NEW
		205389				SHALE BURN INSERT DETL NEW
0026855		D0026855				AG PLT. SPINODL BRG SLV NEW
0026445		D0026445				TCI SRCVSB 1/2 DIA./380GP/320EXT. NEW
0026289		D0026389				TCI SRCVSB 9/16 DIA./410GP/430EXT. NEW

REASON: PRODUCT MANAGER'S REQUEST

DISPOSITION OF AFFECTED PARTS: N/A

Prepared By: LEONARD WRIGHT	Approved By: GARY GARCIA	Date: 08 MAR 00	Configuration Mgmt.: S Schindler	Date: 3-8-00
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Smith International
Smith Tool

*** PONCA CITY ***
Indented Bill of Material Report

Date: 08-MAR-00
Page: 1

Item: 0026557	Size: 077	Type: F10T	Features:
ER: 5879	IADC: 437X	Pin Size: 4 1/2	BRG #: 525 - -0540
Rev: --	EO: 24017	Status: E	Rev Date: 06-MAR-00

Item Description: 077 F10T ER5879 2312 FPD/AG BRG/SF IADC 437X

LEVEL	COMPONENT	REV	DESCRIPTION	QUANTITY	UOM
1	0026848	--	1 CONE 077 F10T ASSEMBLY	1.000	EA
2	D205380	--	DWG 1 CONE 077 F10T ASSEMBLY		
2	D205376	--	DWG 1 CONE 077 F10T PROF & DRILL		
2	0009874	D	SRTC TCI 1/2 FB .203 EXT/.470 GP/GR 411H	1.000	EA
3	D0009874	--	DWG SRTC TCI 1/2 FB.203 EXT		
3	3-1	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
3	50-6(S)	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
2	0026445	--	SCRVB TCI 1/2 FB .320 EXT/.380 GP/GR 614	9.000	EA
3	D0026445	--	DWG SCRVB TCI 1/2 FB .320 EXT		
3	3-1	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
3	50-6(S)	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
2	0026289	--	SCRVB TCI 9/16 FB.430 EXT/.410 GP/GR 614H	14.000	EA
3	D0026289	--	DWG SCRVB TCI 9/16 FB .430 EXT		
3	3-1	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
3	50-6(S)	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
2	0022626	--	RGCSS TCI 13/32FB .230 EXT .310 GP/GR 510H	18.000	EA
3	D0022626	--	DWG RGCSS TCI 13/32 FB .230 EXT		
3	3-1	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
3	50-6(S)	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
2	9977707	A	F TCI 1/4 FB .000 EXT/.190 GP/GR 311	18.000	EA
3	D9977707	--	DWG F TCI 1/4 FB.000 EXT		
3	3-1	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
3	50-6(S)	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
2	D093412	-	CONE CARB DTL		
2	D205388	--	CONE BRG DTL		
	0026849	--	2 CONE 077 F10T ASSEMBLY	1.000	EA
2	D205381	--	DWG 2 CONE 077 F10T ASSEMBLY		
2	D205377	--	DWG 2 CONE 077 F10T PROF & DRILL		
2	0000231	-	C TCI 7/16 FB.204 EXT/.410 GP/GR 510H	2.000	EA
3	D092765	-	MAIN ENGR DRAW		
2	0026289	--	SCRVB TCI 9/16 FB.430 EXT/.410 GP/GR 614H	25.000	EA
3	D0026289	--	DWG SCRVB TCI 9/16 FB .430 EXT		
3	3-1	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
3	50-6(S)	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
2	0018265	--	RGCSS TCI 3/8 FB .200 EXT .310 GP/GR411	15.000	EA
3	D0018265	--	DWG RGC TCI 3/8 FB .200 EXT.		
3	3-1	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
3	50-6(S)	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
2	9977707	A	F TCI 1/4 FB .000 EXT/.190 GP/GR 311	15.000	EA
3	D9977707	--	DWG F TCI 1/4 FB.000 EXT		
3	3-1	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
3	50-6(S)	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
2	D093412	-	CONE CARB DTL		
2	D205388	--	CONE BRG DTL		
	0026850	--	3 CONE 077 F10T ASSEMBLY	1.000	EA
2	D205382	--	DWG 3 CONE 077 F10T ASSEMBLY		
2	D205378	--	DWG 3 CONE 077 F10T PROF & DRILL		
2	9977315	C	SRTC TCI 7/16 FB .190 EXT/.360 GP/GR 411H	1.000	EA
3	D9977315	--	DWG SRTC TCI 7/16 FB.190 EXT		

Smith International
Smith Tool

*** PONCA CITY ***
Indented Bill of Material Report

Date: 08-MAR-00
Page: 2

Item: 0026557	Size: 077	Type: F10T	Features:
ER: 5879	IADC: 437X	Pin Size: 4 1/2	BRG #: 525 - -0540
Rev: --	EO: 24017	Status: E	Rev Date: 06-MAR-00

Item Description: 077 F10T ER5879 2312 FPD/AG BRG/SF IADC 437X

LEVEL	COMPONENT	REV	DESCRIPTION	QUANTITY	UOM
3	3-17315	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
3	50-6(S)	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
2	0026445	--	SCRVB TCI 1/2 FB .320 EXT/.380 GP/GR 614	5.000	EA
3	D0026445	--	DWG SCRVB TCI 1/2 FB .320 EXT		
3	3-1	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
3	50-6(S)	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
2	0026289	--	SCRVB TCI 9/16 FB.430 EXT/.410 GP/GR 614H	13.000	EA
3	D0026289	--	DWG SCRVB TCI 9/16 FB .430 EXT		
3	3-1	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
3	50-6(S)	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
2	0023857	--	RGCSS TCI 7/16FB .250 EXT .310 GP/GR 510H	18.000	EA
3	D0023857	--	DWG RGCSS TCI 7/16 FB .250 EXT		
3	3-1	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
3	50-6(S)	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
2	9977707	A	F TCI 1/4 FB .000 EXT/.190 GP/GR 311	18.000	EA
3	D9977707	--	DWG F TCI 1/4 FB.000 EXT		
3	3-1	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
3	50-6(S)	-	SPEC TUNGSTEN CARBIDE INSERTS		EA
2	D093412	-	CONE CARB DTL		
2	D205388	--	CONE BRG DTL		
	0026854	--	LEG 077 OSVB/32.5 JRNL/.312 OFFSET/2.360-C	3.000	EA
2	D205383	--	DWG LEG 077 F10T DOMEVENT W/SHALE GROOVE		
2	9991780	A	LEG FORG/OSVB 073-077 FTCTI/FMT (4815)	3.000	EA
3	D087651	D	LEG FORG/OSVB		
3	D087656	B	LEG FORGE INSP		
2	9860104	-	HC-1 HARDMETAL	0.309	LB
2	9860427	-	HARDMETAL ROD ST-70M	0.027	LB
2	9976500	B	F TCI 7/16 OD 9/32GP/GR 311/.015 CHAMF	3.000	EA
3	D081257	B	DWG F TCI 7/16 OD		
2	0024824	--	1/4 FLAT SHALE BURN PLUG	3.000	EA
3	D0024824	--	DWG. 1/4 FLAT SHALE BURN PLUG		
2	D099548	B	LEG PAINT OFF		
2	D098790	F	RSVR DETAIL		
2	D089087	A	JET CIRC DETAIL		
2	D203413	--	LEG MILLING DTL		
2	D205385	--	JRNL FINISH DTL		
2	D205384	--	JRNL MACH DTL		
2	D205386	--	LEG REMILL DTL		
2	D205389	--	SHALE BURN INSERT ASSY		
	9977347	B	BHP 7/16 DIA 2.17 LG - .110 LIP	3.000	EA
2	D090795	L	DWG BHP		
	9970531	B	7/16 DIA BALL	42.000	EA
2	D0024795	B	DWG BALL BEARING		
2	50-6(B)	-	SPEC - 50-6(B)		EA
	0026855	--	AG PLT/SPIN.BRG.SLV 1.9935ID X.070 X .540	3.000	EA
2	D0026855	--	DWG SILVER SPINODL BRG SLV (PRO-E)		
	0018415	A	BULLET SEAL 077-084	3.000	EA
2	D200502	A	DWG BULLET SEAL		
	0021740	A	077 - 097 DOMEVENT II RSVR ASSY	3.000	EA

Smith International
Smith Tool

*** PONCA CITY ***
Indented Bill of Material Report

Date: 08-MAR-00
Page: 3

Item: 0026557 Size: 077 Type: F10T Features:
ER: 5879 IADC: 437X Pin Size: 4 1/2 BRG #: 525 - -0540
Rev: -- EO: 24017 Status: E Rev Date: 06-MAR-00

Item Description: 077 F10T ER5879 2312 FPD/AG BRG/SF IADC 437X

LEVEL	COMPONENT	REV	DESCRIPTION	QUANTITY	UOM
2	D0021740	A	DWG 077-097 DOMEVENT II RSVR ASSY (PRO-E)		
2	0021735	A	077-097 CANNISTER: DMVT II	3.000	EA
3	D0021735	A	DWG 077-097 CANNISTER: DMVT II (PRO-E)		
2	0021710	--	077-097 DMVT II RSVR BOOT ASSEMBLY	3.000	EA
3	D0021710	--	DWG 077-097 DMVTII RSVR BOOT ASSY W/9RIBS		
3	0021909	--	077-097 BOOT RUBBER: (PRO-E)		EA
3	0021711	--	077-097 DMVT II BOOT REINFORCING SLEEVE		EA
4	D0021711	--	DWG 077-097 DMVT II BOOT R.F. SLV (PRO-E)		
3	0021712	B	077-097 DMVT II BOOT DISC		EA
4	D0021712	B	DWG 077-097 DMVT II STEEL BOOT DISC (PRO-E)		
4	50-6(N)	-	SPEC - 50-6(N)		EA
2	0021736	--	077-097 RSVR END CAP: DMVT II	3.000	EA
3	D0021736	--	DWG 077-097 RSVR END CAP: DMVT II (PRO-E)		
2	0021713	A	077-097 BELLEVILLE SPRING: DMVT II	3.000	EA
3	D0021713	A	DWG 077-097 (STAINLESS) B-SPRING: (PRO-E)		
3	50-6(L)	-	SPEC - 50-6(L)		EA
2	0021737	--	077-097 DMVT II RETAINING RING	3.000	EA
3	D0021737	--	DWG 077-097 RETAINING RING (PRO-E)		
2	0017620	A	PIPE PLUGS (FLUSH TOP) 1/8-27 - 7/8 TAPER	3.000	EA
3	D200049	A	DWG PIPE PLUG (FLUSH TOP) (PRO-E)		
2	0016327	-	077-097 CANNISTER O-RINGS MAT'L NBR-R	6.000	EA
3	D093799	A	DWG O-RING STATIC		
	9970669	C	O-RING STATIC AS 568-218 / 95 SERIES	3.000	EA
2	D093799	A	DWG O-RING STATIC		
	9930677	A	BOX ASSY (C) 7 5/8 - 7 7/8 3-CONE BITS	1.000	EA
2	9930659	A	BIT BOX C,CC 075 - 077 ALL TYPES	1.000	EA
3	D090378	L	DWG BIT BOX PRINTING & INSIDE DIMENSIONS		
2	9930660	-	BOX LINER (CC) 7 5/8 - 7 7/8 ALL TYPES	1.000	EA
3	D090379	H	DWG BIT BOX LINER		
2	0004897	-	BOX STABLZR (C) 7 5/8 - 7 7/8 ALL TYPES	1.000	EA
3	D095287	E	DWG BIT BOX STABILIZER		
2	9930043	-	BOX TOP (C) 7 5/8 - 7 7/8	1.000	EA
3	D090380	J	DWG BIT BOX TOPS & BOTTOMS		
2	9930044	-	BOX BOTTOM (C) 7 5/8 - 7 7/8 (PLYWOOD)	1.000	EA
3	D090380	J	DWG BIT BOX TOPS & BOTTOMS		
2	9930663	A	BOX BOTTOM (C) 7 5/8 - 7 7/8 (FIBRBOARD)	1.000	EA
3	D090380	J	DWG BIT BOX TOPS & BOTTOMS		
2	0018573	--	BIT BOX LABEL (LARGE)	1.000	EA
3	D200136	A	DWG BIT BOX LABEL (LARGE)		
3	0017781	-	BIT BOX LABEL (LARGE)	1.000	EA
3	0017782	-	BIT BOX LABEL (LARGE)	1.000	EA
	9860483	-	BIT GREASE STL-057	1.000	LB
2	9860484	-	GREASE-BRG & O-RING-TEXCLAD #2	0.500	LB
2	9860485	-	PIN PROT COATG-TEXACO COMPND "L" RUST PREV	0.125	LB
2	9860486	-	WELD FILLER-SEAMS & CROWN-AWS E70S-6	1.000	LB
2	9860487	-	WELD FILLER-BALL HOLE PLUG-AWS E70S-6	0.125	LB
	0000091	-	VEE SHIM/OSVB 073 - 077 BITS	1.000	EA
2	D039769	B	DWG VEE SHIM/OSVB		
	0000092	-	SIDE SHIM/OSVB 073 - 097 BITS	3.000	EA

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*** PONCA CITY ***
Indented Bill of Material Report

Date: 08-MAR-00
Page: 4

Item: 0026557 Size: 077 Type: F10T Features:
ER: 5879 IADC: 437X Pin Size: 4 1/2 BRG #: 525 - -0540
Rev: -- EO: 24017 Status: E Rev Date: 06-MAR-00

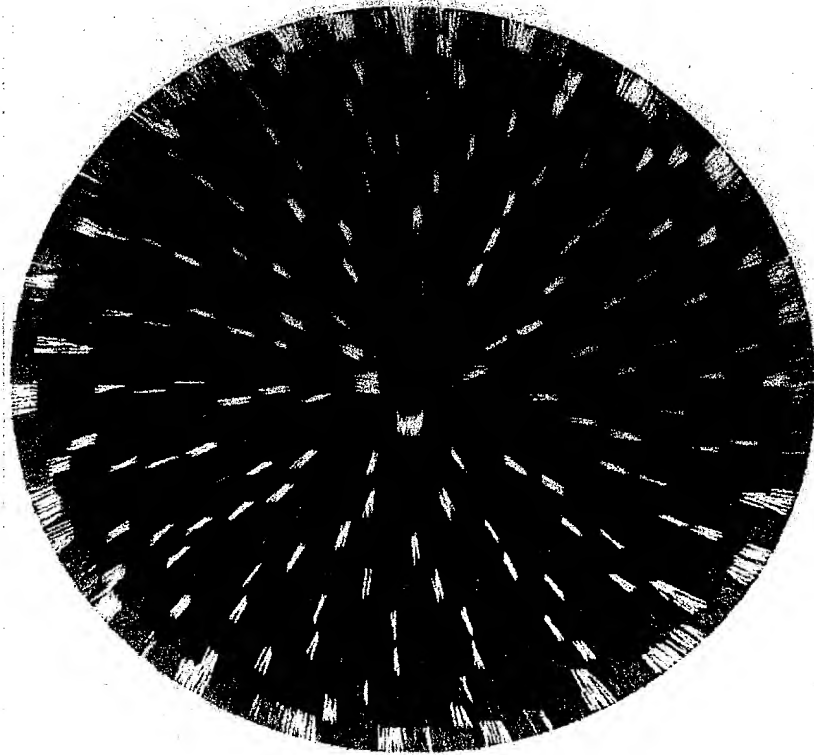
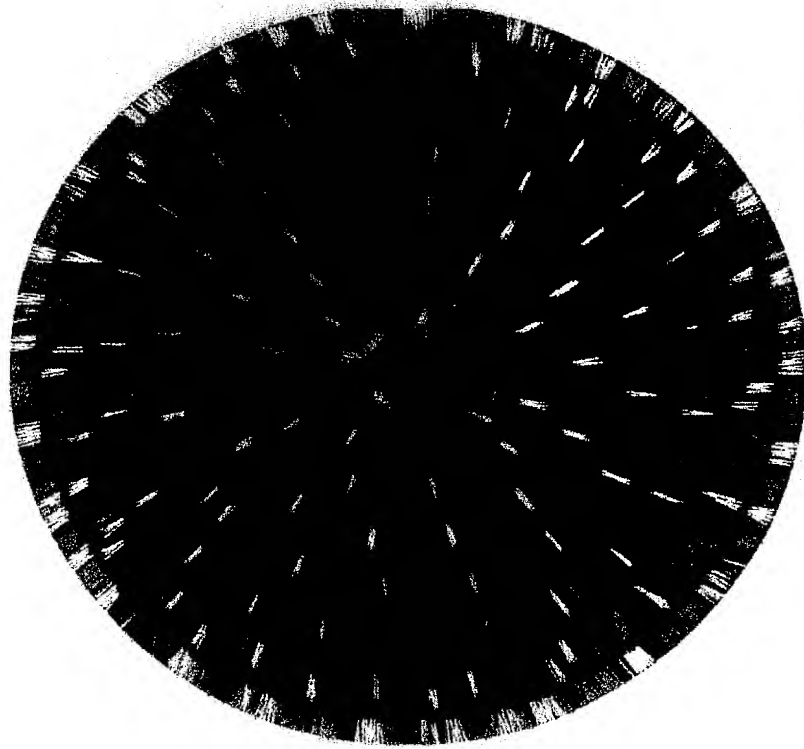
Item Description: 077 F10T ER5879 2312 FPD/AG BRG/SF IADC 437X

LEVEL	COMPONENT	REV	DESCRIPTION	QUANTITY	UOM
2	D044887	B	DWG SIDE SHIM/OSVB		
	9974315	A	DOME SHIM/OSVB 7 5/8 - 7 7/8 BITS	1.000	EA
2	D046369	A	DWG DOME SHIM/OSVB		
	0009960	-	BIT BOX LABEL #2 - "SCULPTURED" INSERTS	1.000	EA
2	D095644	-	DWG BOX LABEL #2 - "SCULPTURED" INSERTS		
	0014200	E	THRUST WASHER 1.059ID X 1.820ODX .070 SLV	3.000	EA
2	D098470	E	DWG THRUST WASHER (SILVER PLATED)		
	9860482	-	BIT PAINT-METALLIC GREEN LACQUER	0.250	LB
	D095459	A	SEAL SEL CHART		
	D205379	--	DWG LAYOUT LT077-F10T-04		

*** End of Report - INDENTED Bill of Material Report ***



IDEASTM Bit Design: 7 7/8 ER5897 (F47H)



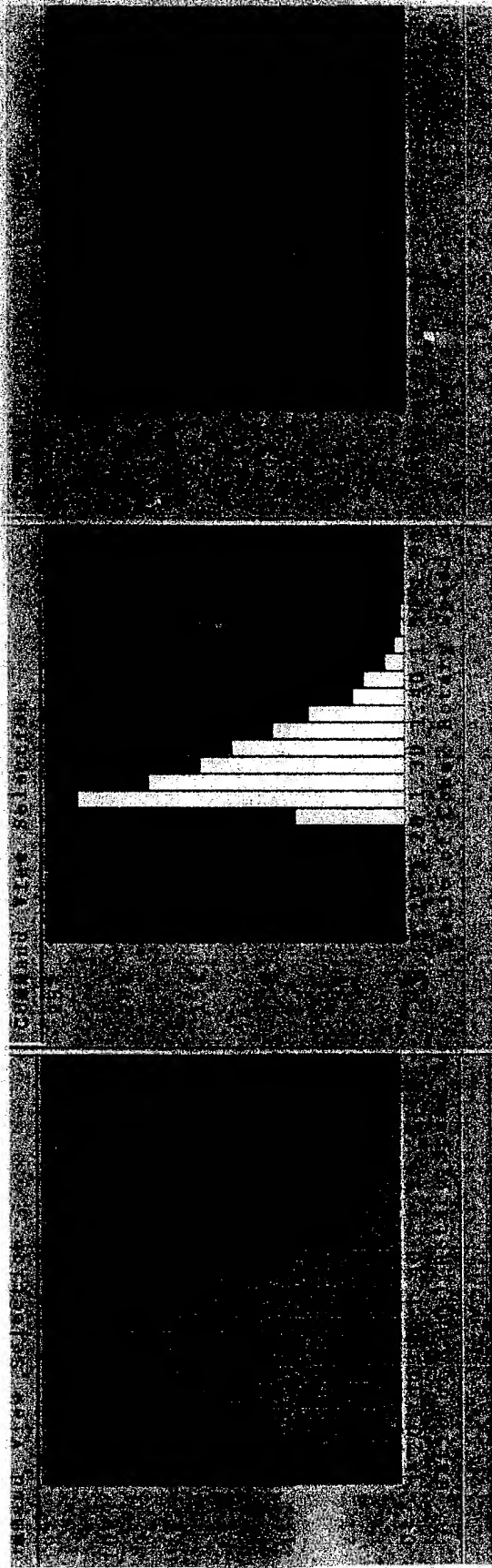
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077 ER5897

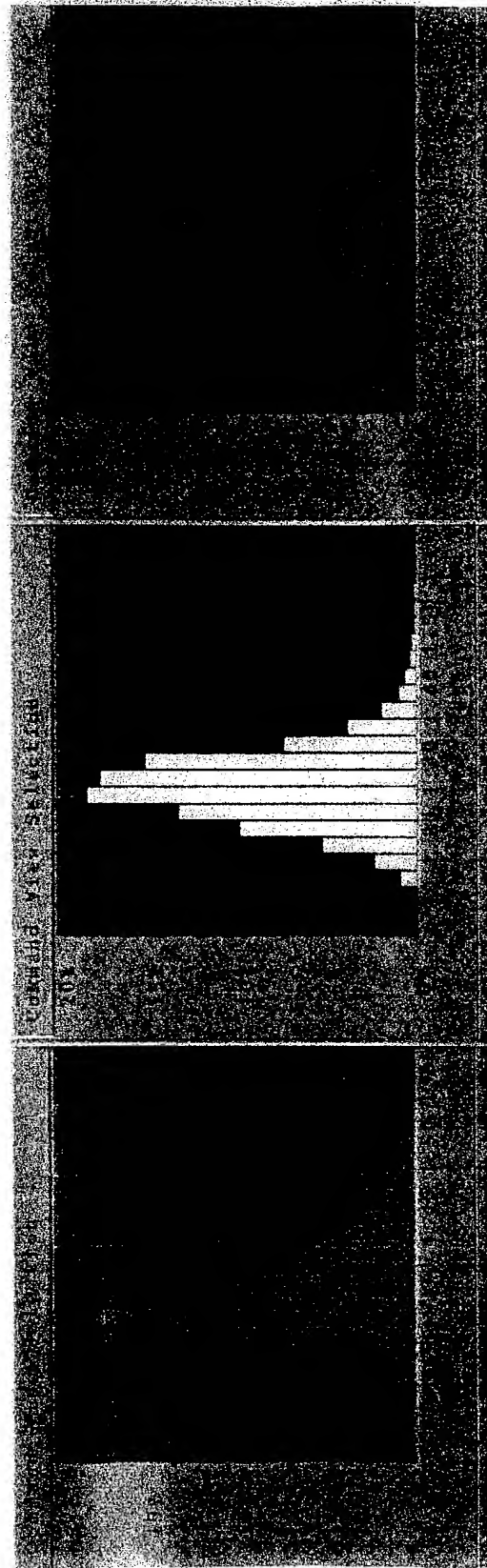
SMITHCOLOR0039
CONFIDENTIAL

IDEAS

STD 077 F47H



077 ER5897

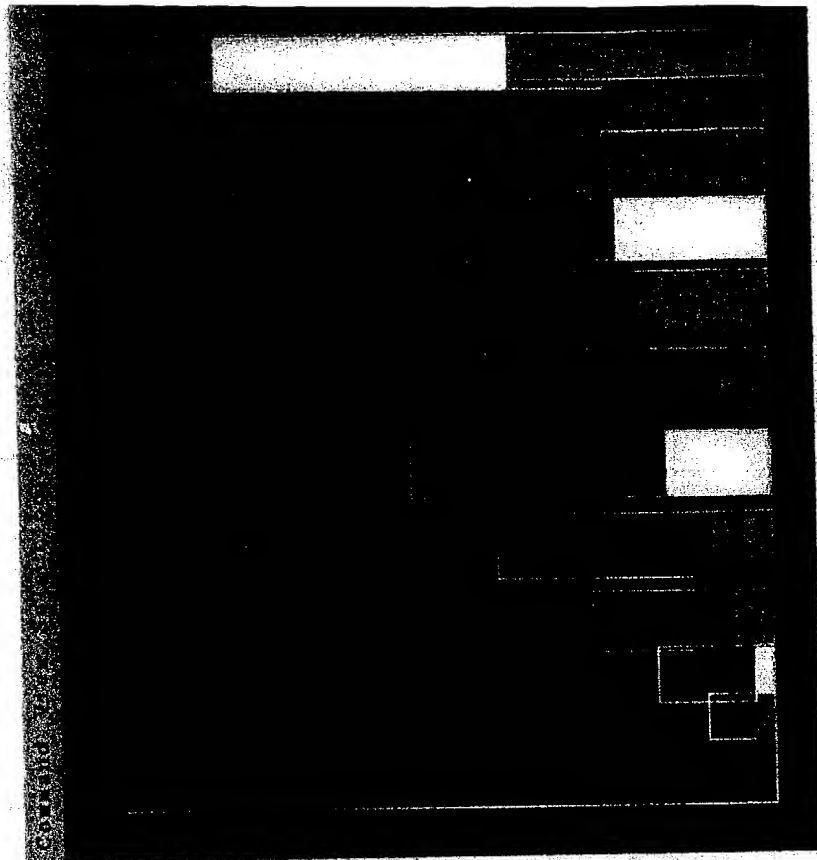
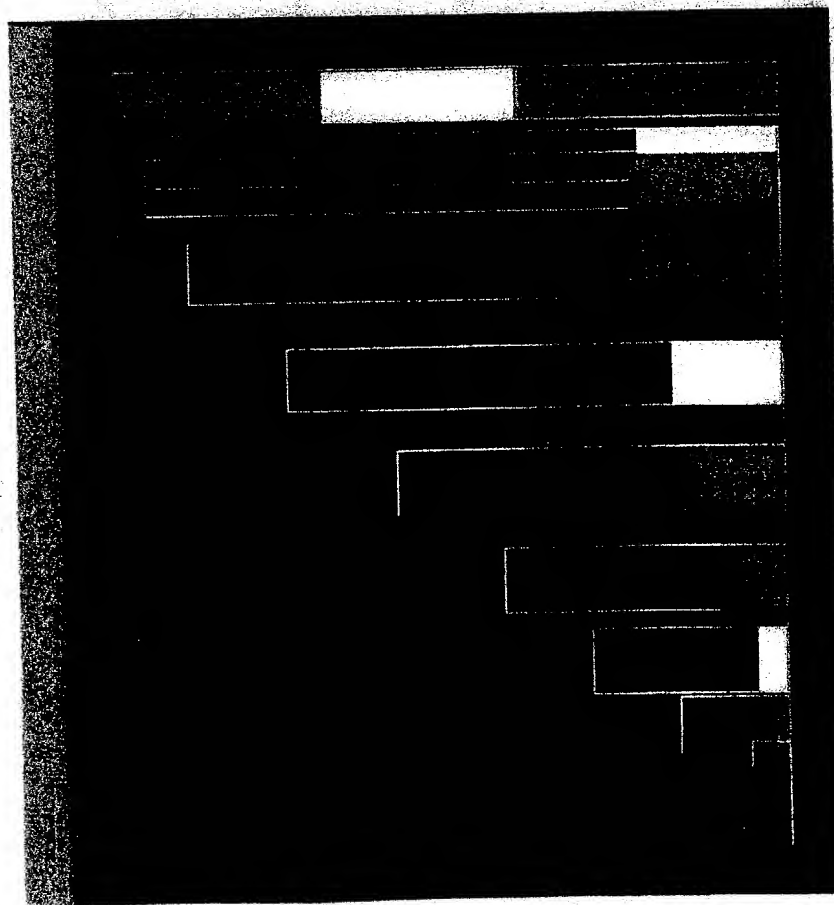


SMITHCOLOR00394
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IDEAS™ Bit Design: 7 7/8 ER 5897 (F47H)

077 ER5897

STD 077 F47H



SMITHCOLOR0039
CONFIDENTIAL



IDEAS™ Bit Design: 7 7/8 ER5897 (F47H)

STD 077 F47H

077ER5897

